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THE ANTHROPOLOGY OF CALIFORNIA[1]

FOR many years California was among the regions of North America of which anthropologists knew least. The early traveler touched it, the missionary occasionally left a valuable but fragmentary record, and the resident at times described the native people who were thrown under his observation. But the anthropologist and the trained investigator sought other fields of exploration, and the fact that extensive archeological collections had been formed from one restricted region contributed very little to a knowledge of the general anthropology of the state. Of recent years these conditions have been entirely altered. Several institutions have formed systematic collections or carried on researches, until now the anthropology of the region is nearly as well known as that of most parts of the continent, and certainly presents less obscurities than some. It seems fitting, therefore, to undertake at this time a review of the principal results of study, and of the new problems that these results inevitably open up. It might seem that the student of aboriginal people should be little concerned with the arbitrary limits of a modern political division such as the present state of California. As a fact, however, these limits coincide so nearly with the natural physiographical and ethnographical boundaries, that the artificiality of such a limitation, in an

[1] Address of the retiring vice-president of Section H of the American Association for the Advancement of Science, at the Chicago meeting, 1907–8.

anthropological consideration, is apparent rather than real.

The anthropologist needs no justification for directing his attention first to language. Not only is language recognized as the necessary means to a really exact understanding of the life of any people; it is also the most generally useful instrument of anthropological classification, and one of the aids to historical knowledge which is at times of the most fruitful service when all other methods, even archeology, fail. Particularly in a region like California, where the multiplicity of languages is so marked, and where an absence of other means of segregation and grouping is customary, does an understanding of the linguistic relationships become indispensable.

Thirty years ago the number of distinct linguistic stocks in California was pretty accurately given as about twenty, and Powell's great systematizing work fifteen years later determined the number as only slightly larger. Since then no entirely new languages have been discovered. We may therefore say with certainty that the number of native linguistic families will never be regarded as greater than it is now. On the other hand, recent studies show very little tendency to reduce the total number of stocks. The Shasta and Achomawi have been found related, but this affinity had been at least suggested many years before. That here and there languages, such as Pomo and Chimariko, have certain important words in common with others, such as Shasta, or with one another, is not necessarily an indication of relationship. It seems that almost every stock in California has at least a few words in common with neighboring or more distant languages, but that such words represent a borrowing or diffusion. This is established not only by the small number of such words, but also by the fact that they are frequently common to more than two languages. It would seem as if words of certain significances had been particularly liable in California to spread as loan words to unrelated languages. Even if some further unifications of languages now considered distinct should in future be made by the students of California linguistics, there is no reason to suppose that such a reduction in the number of stocks will be proportionately greater than elsewhere in the North American continent. It is only necessary to recall that a number of conservative scholars believe, or have proclaimed, the relationship of Natchez with Muskogi, of Selish with Kwakiutl, of Sahaptin with one or more of the neighboring languages, of Seri with Yuman, of Shoshonean with Piman and Nahuatl, to become convinced that any analogous conclusions which may be reached in California will not be special, but will form part of a general reduction in the number of distinct linguistic branches, which is almost certain to take place as knowledge gradually increases.

As regards the minor divisions of language, system has pretty well replaced chaos in California. It can not be pretended that all the dialects are even tolerably well known, but at least the number of dialects has been definitely determined in all regions where the practical extinction of the Indians has not made such a determination almost impossible. We know not only the total number of divisions of each linguistic family at the time of first contact with the whites, but also something of the relative degree of divergence of these divisions. The loose statements formerly sometimes made that the number of unrelated dialects of one stock was often very great, and that these dialects showed a gradual continuous change from one end of the territory of a family to the other, have been found to be entirely erroneous. In most cases the divisions of each family are few

in number—with two or three exceptions never above six or eight—and they are usually well marked. Over a certain area the speech is identical or practically uniform. In leaving this area for an adjacent one, an abrupt change to another form of speech is encountered, which in turn is uniform over its entire extent. In many cases the changes met in passing from one of two adjoining areas to the other are so great that it would perhaps be more correct to designate their forms of speech as related languages than as dialects. A number of the smaller families are monodialectic. The total number of distinct languages or dialects in the state, excepting those whose divergence is comparatively inconsequential, was not over a hundred, and more probably about seventy-five. The total of distinguishable forms of speech may have numbered twice this.

Structurally the languages of California are usually characterized by a certain simplicity or transparency. As has been pointed out, there are, however, two regions, one in the northwest and one in the southwest, where this morphological quality is lost, and in which certain other qualities seem to be common to the several languages of the area. It has therefore been possible for some years to distinguish a northwestern, a southwestern, and a large central morphological group of languages. The most recent investigations confirm this classification; but it is necessary not to endow the grouping with too much significance. As each language is studied individually, and becomes more thoroughly known, it is obvious that it must prove to possess certain peculiarities that separate it from all others, even of the same morphological type; and from the standpoint of any given language such peculiarities are of course of more importance, and of greater value to the student, than the more vague similarities to the type, which it is plain can be based only on a few characteristics of either an essentially external nature or of the most general kind. The existence of the morphological groups is evident, but it must also be clear that they are only morphological groups of languages that are unrelated, and that therefore the bare circumstance that a certain language forms part of a particular group, furnishes no understanding, of that language, that is more than skin deep.

As to the significance of the morphological groups, it is clear that the lesson to be drawn from their determination is not a belief in the ultimate relationship of the languages constituting a group, but the emphasizing, by fresh examples, of the principle of territorial continuity of characteristics. This is not the occasion to discuss the much debated question of whether vocabulary or structure is the more reliable criterion of linguistic relationship. However this question be answered, the similarities as yet found between the languages of the three California groups are not of such a nature as to be of bearing on the consideration of their genetic unity. The importance of a proper conception of the frequency and influence of territorial continuity of characteristics is still too little recognized, especially among linguists, though instances of its occurrence are numberless. No one impressed with the prevalence of this historic principle would, for instance, dare to affirm, as eminent men have done, the relationship of the languages of southeastern Asia because they are isolating, or of Japanese with Ural-Altaic merely because both use suffixes in abundance.

The probable cause of the multiplicity of linguistic stocks in California may be said to be becoming a little clearer. The division of many of the stocks into sharply distinct dialects or languages indicates how many of them may have originated by a

mere process of divergence, continued until practically all traces of original relationship have now become obliterated. While, as has been said, there seems at present no great prospect that we shall ever obtain conclusive evidence as to such original unity of linguistic stocks now apparently unrelated, it is clear that if the processes which have more recently been at work dividing original stocks into distinct languages, have been operative in this region for a considerably longer period, as is only natural, there must have been some such result as the gradual formation of what we now call distinct families. In any case nothing has ever been discovered that supports the so-called fish-trap theory, according to which the multiplicity of languages in California is due to the successive crowding, into this more desirable habitat, of waves or bands of unrelated immigrants from less favorable territories, to which none of them were ever willing to return. While this theory is at once simple and plausible, it has never been anything else than purely hypothetical.

It is still sometimes thought that areas of diverse native languages can be pretty closely correlated in California with areas that are physiographically distinct. Nothing is more erroneous. True, as there are so many forms of speech, the great majority of them can extend only over a small territory, and it is only natural that a small territory should often be confined entirely to a certain physiographical area. But there are numerous instances where not only linguistic families, but even dialects, run counter to all natural boundaries. The Shoshoneans and Washo have both spilled over the high crest of the Sierra Nevada. The Pomo west of the main Coast Range have an offshoot in the Sacramento valley, and the Wintun of this valley occupy territory west of the Coast Range. The Yurok are in part an ocean people, like their neighbors the Wiyot, and in part a river people on the same stream as their neighbors the Karok. Shoshonean people lived in the timbered Sierra, in the Great Basin drainage, the hot deserts of the interior of southern California, the fertile parts of the coast region of southern California, and shared the Santa Barbara islands with the Chumash. The southern Maidu dialect was spoken in the Sacramento valley plains, in the foothills, and in the high Sierra. The northern and central Pomo dialects were each spoken on the immediate coast, in the open Russian river valley, and in the intervening heavily timbered mountainous redwood belt. In certain instances where languages or dialects correspond to physiographic areas, these physiographic areas lack any separating barrier. Thus among the Yokuts and Miwok the dialects of the level plain of the San Joaquin valley are with scarcely an exception quite sharply distinct from the dialects of the adjacent foothill country of the Sierra; and yet the change from plain to hills is so gradual in some parts as to be scarcely visible. It is clear that in such cases the direct cause of the difference of speech is not the environment itself, but a difference in association and mode of life dependent upon physical geography. In fact it is even going too far to name these dialectic divergences as effects and other factors as causes; we are really only justified in saying that the differentiation of speech seems to be causally related with other factors, and that these are immediately cultural and historical, and only indirectly physical and environmental.

Much the same is true of the demonstrable relations of culture and environment. There are instances of the effect of environment on culture in parts of California, which could not well be more vivid; and yet these same instances show also the

narrow limits which are imposed upon environmental effect by culture and history. On Tulare lake, in the southern part of the great interior valley of California, live the Tachi and Yokuts tribes. On Clear Lake, in the northern Coast Range, are the eastern and southeastern Pomo. On the Klamath and adjacent lakes, in northeastern California and in Oregon, are the Klamath Lake and Modoc people. All three groups of people have developed certain aspects of their material culture in a very similar direction through the use of a material furnished by their lake environment, the tule or bulrush. Not only houses, mats and boats, but clothing, footwear, cradles, baskets and games are made of this abundant and useful material. A glance at a museum collection from the three regions not only seems to reveal a practical identity of culture, but would make it appear that the eastern Pomo and Tachi Yokuts were culturally more nearly akin to each other than to their respective Pomo and Yokuts neighbors and kinsmen. But the moment the social and religious institutions of these people are considered, the resemblances in industries and arts are counterbalanced and as it were nullified. In ceremonies and habits and customs the eastern Pomo are as distinctively Pomo as any other branch of the family; and so the Tachi are as good Yokuts in religion, in beliefs and in social organization, as they are in language. Even on the material side of life environment is not the only causal factor. The Modoc twines his tule basket, the Tachi coils it, because those are the characteristic textile processes of the culture region in which each lives.

Of course even social life and religion will be colored by environment, and their development can extend only within a certain compass given by environment. But this is self-evident. No one, whether anthropologist or historian, has denied the significance of physical nature as a cultural condition; but the attempt has too often been made, sometimes expressly, more frequently by implication, to derive and explain a culture entirely from geography and climate; and nothing is more unfounded. For the sake of argument it may be granted to those who so wish, that in the ultimate analysis everything historical and everything human is the effect of physical nature. But, on the other hand, too strong a protest can not be made against the assumption which is often unwarrantably and illogically made from this view, that the actual immediate specific causes which have shaped the life of any given people can be sought and found in their particular environment. A body of people, neither at present nor at any time in their history, are ever a clean fresh slate ready to be inscribed by nature. No matter how rude their civilization, it has always a long historical background and is deeply rooted; and it is only upon this complex institutional life that a particular environment can begin to act. In time, no doubt, environment will partially modify all the institutions with which it is brought in contact. But institutions have a life of their own, influence each other, and undergo their own developments and histories. They must be always affected but can never be controlled by nature. Change of environment can destroy an institution by making it unnecessary or impossible, or can be the stimulus which develops a new institution; but in either case something cultural, an existing body of institutions, is present and is acted upon by the stimulus; and this body of culture is in turn dependent upon previous factors that are both cultural and environmental. To look to physical environment for the explanation of cultures is to mistake condition for cause.

The three regions of generally distinct

culture which have been recognized in California seems to be substantiated by further researches. Of course any culture-area or ethnographical province is relative. It rarely has sharply limited boundaries. To hold that what is important about it are not its external limits, but its internal center of dispersion, is good doctrine, but impracticable, in most cases, owing to lack of historical material. Thus, as compared with the rest of America, California seems a well-marked and well-defined province. In a broader view of the peoples of the world, its distinctive characters largely disappear, or are seen to coincide with such as are typical of the whole of America. On the other hand, when California is viewed by itself, the northwestern, the central and the southern areas contrast strongly. But the moment each of these three is considered alone, culturally well-defined groups of tribes are evident within it. This does not weaken the value of the recognition of culture-areas. The genus breaks up when we consider species. Even the species seems no longer a unit when attention is allowed to be given to races. But the differences between genera become insignificant when the family and the order are in view. Neither the order nor the species, the race nor the genus, is, therefore, unimportant or unreliable. A biology recognizing only species is a scientific impossibility; but a biology dealing with nothing lower than genera would be equally impossible. The culture-area, broad or minute, has its value, and in fact is indispensable, as a means to a historical understanding of its components; but it has value only so long as its relativity is recognized.

The northwestern culture-area of California may in some respects be considered the most southerly extension of the distinctive and rather highly organized culture which centers on the Pacific Coast north of Puget Sound. The Yurok and Hupa and Wiyot house is the same in plan as the plank house as far north as Alaska. Immediately to the south, among the Yuki, Wintun, and southern Athabascans, it is replaced by the central Californian brush or bark hut or earth-covered house. The same tribes of northwestern California are the most southerly among whom a well worked-out system of social organization dependent on wealth exists. All through California the rich man was the chief; but only here was every one's standing in the community, and the value of his life and of his children, definitely regulated and expressed in terms of wealth. In this northwestern region, too, is marked the southernmost extension on the Pacific coast of the prevalence of culture-hero and transformer myths. Immediately to the south, creation myths begin. Nevertheless we may well hesitate before counting northwestern California within the North Pacific coast culture. In general scope and tone, life was at least as similar to that of central California as to that on the lower Columbia or in the vicinity of Puget Sound. In addition, there has clearly taken place in this region an independent local development which has more or less influenced the entire culture. The implements, the ceremonies, the beliefs, found only in this region, are exceedingly numerous, and seem to reach the highest development among the Yurok, the Karok, and the Hupa. The remaining Athabascans, the Wiyot, the Shasta, and the Chimariko, who surround these three more highly organized tribes, belong to the same general culture while lacking many of its most individual features.

In southern California, at least three sub-areas of culture, connected largely with environment, are distinguishable. Unfortunately, the people of what was perhaps the most interesting of these, the

Santa Barbara coast and archipelago, were ethnologically extinct long before ethnologists visited their territory. We know of them only from brief notices of travelers and through the less perishable artifacts they have left in their village-sites. As a more or less maritime people, their mode of life must have been quite different from that of the other Indians of southern California, and no doubt their institutions and beliefs also showed much that was peculiar but which we can not even speculate upon.

The people in the fertile and semi-fertile mountain and coast regions of southern California were the most similar, of those in the south, to the central and northern Californians. Their habitat was not essentially different from the greater part of California. Their mode of life is, therefore, naturally also similar to that of central California. In religion, however, especially in the matter of beliefs, there is much that is either distinctive or shows relations with the Pueblo culture. Even the arts are not free from resemblances in this direction.

It is therefore the more surprising that the agricultural Yuman tribes of the Colorado river, to the east of the last group of people, and therefore so much nearer the Pueblo region, evidence no great approximation to Pueblo or southwestern life, even though they are in many respects typically un-Californian. Even such of their cultural features as they appear to have acquired through Pueblo influence, as, for instance, their pottery, have a non-Pueblo character. Their religious life is especially distinct, lacking even certain traits which their Californian neighbors to the west share with the Pueblos and other tribes to the east. In the ceremonies of the Mohave are found no masks, no altars, no painting or carving of ceremonial paraphernalia, the simplest of regalia, no seasonal observances, no societies, and no initiation; and all this in spite of the fact that they maintained some degree of intercourse with the Hopi.

In the great central region of California cultural uniformity is stronger than in the south, not so much through the persistence of certain special positive features, as in a fundamental similarity that is varied only locally. Thus the weaves, the shapes, the patterns and the materials of baskets differ, but basketry is everywhere the most developed and most important art, nowhere replaced by pottery or working in wood. Creation myths and mourning ceremonies vary in form from district to district, but everywhere dominate mythology and public religious expression. Too great a uniformity will not be expected when it is realized how limited the geographical knowledge and intercourse of most of the California Indians were. It is probable that the southern Yokuts did not more than know of the existence of the southern Miwok. These in turn knew no more of the southern Maidu. The southern Maidu may not have been aware that there was such a people as the Shastan Achomawi of Pit River. Again, the Maidu of the higher Sierra did not know more than the easternmost Wintun. These appear to have come in contact only with the easternmost Pomo. The eastern Pomo had but little to do with their western kinsmen on the coast. Whether one traveled from south to north, or from east to west, through the central province of the state, he would, therefore, encounter, in aboriginal times, at least two or three groups of people mutually ignorant of each other's existence; and this condition was probably more marked in north-central than in south-central California. In this respect central California differed as a culture-area from such much more extensive but better interconnected regions as the Plains, or the district of the Great Lakes and

Alleghanies; or probably even the north Pacific coast and the southwest, where at least the majority of tribes had some communication with the majority of others. With the restricted intercourse in central California, common cultural traits should be chiefly general, or of a negative character, and local divergences numerous. The degree of uniformity which exists is, therefore, the more significant.

From the first, archeological investigation in California has concerned itself with questions of time more than with those of culture. It was inevitable that this should be so from the sensational if as yet unsubstantiated discoveries of a generation ago. Of recent years there has been rigorous search for evidences of the geological antiquity of man, and positive results from which would have been the more reliable from the fact that the work has been controlled by geologists. It can not be said, however, that more has yet been shown than that there are good prospects for the ultimate establishment of the existence of man in the state at an early period. But a clue is not a discovery, and probability and opinions represent precisely the status of the question which it is desirable to leave behind. Of recent years no one has ventured to assert positively the human origin of the possible artifacts dating with certainty from Quaternary time, or the geological antiquity of finds of unquestionably human origin. Until such an unequivocal statement of faith is made by those most inclined to a favorable opinion, the skeptically disposed will doubt. The work that has been done is encouraging; but proof of the geological antiquity of man in California remains to be made.

Rather unexpectedly, investigation of shell mounds and deposits on San Francisco Bay has resulted in evidences of antiquity sufficiently great to be geologically observable. In a number of mounds on the immediate shore-line the base has been found to be from three to twelve feet below the present water level. On the other hand, there is at least one case of an extensive shell deposit at a point more than a mile from water and at some elevation above sea level, the presence of which it is difficult to explain except on the assumption that the shore-line has undergone a corresponding elevation. Of course the question at once arises how great a time would be required to effect such changes in a region subject to seismic disturbances.

On its cultural side archeology seems to show above everything else that, broadly speaking, the civilization of California is of some age, and has scarcely changed during the period, perhaps of thousands of years, through which the accumulating finds take us. There is no trace of pottery in former times where it has not been found in the historic period. There are no evidences of agriculture or of architecture in stone. The plummet-shaped charmstones are found chiefly in regions where their use by the Indians has been seen, or explanations as to their employment have been had from the Indians. The straight tubular pipe is as characteristic of the prehistoric as of the present native inhabitant of the state. The peculiar hooked stone adze handle, the large obsidian blade, the perforated stone, the pestle ringed near the bottom, are found buried in village-sites, and in use by the Indians of to-day, in northwestern California. The more specialized of these forms, such as the adze and pestle, are observed by both archeologist and ethnologist only in this region. It would thus appear that even local cultural characteristics are of considerable age. Scarcely any unexplained types of implements, and no forms of art unpractised at the present day, are found by the archeologist. Even where minor changes have taken place, they are superficial. The bowl-

shaped stone mortar is the commonest archeological find in California. The great majority of the tribes met by the whites did not use such mortars, but a flat slab, or exposed bed-rock, with a mortar or hopper of basketry. Both the prehistoric and the recent people, however, it is clear, lived principally on vegetable food that needed pounding, no doubt acorns above all; and they used the same types of pestles.

Such a close correspondence of the results obtained by the prehistoric archeologist and by the ethnologist investigating present-day conditions, is not a new phenomenon nor confined to California. It recurs in the southwest, on the north Pacific coast, on the plains, to a considerable extent in Mexico, in fact, broadly speaking, over the whole of North America except part of the region between the Mississippi and the Alleghanies. The widespreadness of the correspondence, however, makes it particularly interesting and important, as it seems to show either that all American culture is comparatively recent, or that its principal forms, differentiated a long time ago, have been maintained by a strong conservatism.

The physical anthropology of California is yet in its infancy, but whether it will ever far outgrow this stage seems doubtful. Over great parts of the state prehistoric material for investigation is wanting, owing to the prevalence of the custom of cremation of the dead. In other parts the recent people have become extinct without being measured or photographed. In some regions, such as the Salinas valley, there is neither recent nor ancient material. The map of California will, therefore, presumably always contain large blanks so far as physical anthropology is concerned. At present studies are further restricted through the comparative scarcity of information in most of the surrounding parts. No general correspondences of racial types with cultural or linguistic divisions have been established. In fact, the observed instances more frequently show a lack of correlation. There does not appear to have been any very considerable physical diversification within the limits of the state. Whether a few scattered areas showing aberrant types, such as the long-headed people of the upper waters of Eel River and of the southern Santa Barbara islands, are to be regarded as ethnic islands in which an earlier continuous but now otherwise submerged race has maintained itself to the present in comparative purity; or whether they represent migrations of distinct types from a more remote habitat; or whether they are local developments from a single widely spread and originally uniform type, must yet be considered uncertain.

It may be asked what are the specific problems of the anthropology of California. The most important questions have been outlined in the summary of results that has been given. While something has been done, and some problems have been solved or brought nearer solution, they have only served, as is always the case, to open wider problems. If it has been determined that dialects do not form gradual transitions, but present abrupt changes, a point is gained. But the question at once arises what the conditions are that have brought about and maintained this state. While the structure of some languages is fairly well known, generally through the study of one selected dialect, there are more of which we have only the most superficial conception. If these less-known languages show resemblances among each other, or to the better-known languages, either in content or in form, we need more information than exists in order to follow out the promising comparisons. If half a dozen shell-mounds on San Francisco Bay show varying subsidences below sea level, there

are three hundred others, on the shores of the same body of water, whose subsidence should be similarly investigated to make possible a final determination of the age of the culture of this region; and this is only one region of many where similar archeological phenomena can be studied. The cry of the physical anthropologist is for more material—material which is in part no longer obtainable. The ethnologist is beset by the same difficulty. There is not a people in the state whose institutions and religion have been ascertained with such exhaustiveness as is desirable for purposes of comparisons alone. We know that the Maidu and Wintun had certain ceremonies in common. It now appears that other groups, such as the Pomo and Miwok, also practised certain of these ceremonies. We have some idea of the form which these ceremonies took among the Maidu, with whom they do not seem to have been original; but we lack almost all knowledge regarding them among other tribes—and this is knowledge which can still be secured. There is no doubt that something of the history of the aborigines of California, in broad outlines, but in the specific sense of the word history, will be revealed by the continued pursuit of the various phases of anthropology; but what is needed in all domains of the anthropology of the region is more knowledge, more information, and more facts. However gratifying the results of research have so far been, they show only more clearly the greater results that are possible, and emphasize the means by which alone these results can be attained, which is: more work.

A. L. Kroeber

THE AMERICAN CHEMICAL SOCIETY AND SECTION C OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The thirty-seventh general meeting of the American Chemical Society and the meeting of Section C of the American Association for the Advancement of Science was held at Chicago during Tuesday, Wednesday, Thursday and Friday, December 31 to January 3, in the Kent Chemical Laboratories of Chicago University.

Tuesday morning the organization of Section C was effected and this was followed immediately by the opening session of the American Chemical Society and later by the meetings of the sections.

On Tuesday evening a complimentary smoker was extended to the visiting chemists by the Chicago section of the American Chemical Society at the Sherman House. The cordiality and good cheer of the occasion were so much in evidence that this session extended well over into the new year.

Wednesday afternoon personally conducted excursions were made to the Illinois Steel Company, the By-products Coke Corporation, the American Linseed Company and the Chicago Gas light and Coke Company.

In the evening the society was favored by an address on "American Chemical Societies" by Professor M. T. Bogert, president of the society.

Thursday evening the members of the society banqueted at the Auditorium Annex Hotel. This was one of the most enjoyable events of the thirty-seventh general meeting.

On Friday afternoon excursions were conducted through the plants of the Standard Oil Company at Whiting, Indiana, and to the Union Stock Yards and the packing plant of Swift & Company. A complimentary luncheon was served for the visitors by Swift & Company.

At the last general meeting, on Friday, the society extended a vote of thanks to the Chicago section and all others who contributed so much for the success of the meeting in Chicago.

The attendance at this meeting reached 325, almost the largest in the history of the society.

The following papers and addresses were delivered before the general sessions:

The Application of Physical Chemistry to Organic Chemistry: JULIUS STIEGLITZ.

The Hydronitrogens and their Derivatives: A. W. BROWNE.

A Plea for the Broader Education of the Chemical Engineer: CLIFFORD RICHARDSON.

Some Present-day Problems of Biological Chemists: R. H. CHITTENDEN.

The Passage of Substances into the Human System by Osmosis: LOUIS KAHLENBERG.

American Chemical Societies: M. T. BOGERT.

The Non-equivalence of the Four Valences of the Carbon Atom: J. U. NEFF.

The Chemical Education of the Chemical Engineer: WM. H. ELLIS.

Chemistry in the Government Service: W. D. BIGELOW.

The Interrelations of the Elements: HERBERT N. MCCOY.

The following papers were presented before the different sections:

PHYSICAL CHEMISTRY SECTION

Herbert N. McCoy, Chairman

On the Passage of Substances into the Human System by Osmosis: LOUIS KAHLENBERG.

The experiments began with a study of the treatment of cases of blood-poisoning by means of saturated aqueous solutions of boric acid. In all cases where such solutions are applied to the thoroughly cleansed skin, boric acid is absorbed and makes its appearance in the urine. The percentage found in the urine rarely reaches more than a few hundredths of one per cent.

A large number of pathological samples of urine were examined, their boric acid content being determined colorimetrically by means of a modification of the turmeric paper method. When the feet of a normal individual are immersed in a saturated boric-acid solution up to the ankle, the boric-acid appears in the urine in estimable quantity in ten minutes. The presence of traces may be demonstrated after five minutes. Under like conditions not a trace of lithium passes into the system from lithium chloride solutions. Quite weak solutions and also five and ten per cent. solutions were tried. Chlorides of calcium and rubidium also do not pass into the system. The tests were made by means of the spectroscope. It is a notable fact that through dead animal or vegetable membranes lithium chloride will pass much more rapidly than will boric acid. And when even a small fraction of a grain of lithium chloride is taken into the mouth, the lithium may be demonstrated to be present in the urine in a very short time. When the feet are soaked in a solution of lithium tetraborate, neither lithium nor boric acid is found in the urine. Thus far all attempts to introduce lithium salts into the system by absorption through the skin have been unsuccessful. On the other hand, through the mucous membranes lithium salts readily make their way. Through dead animal and vegetable membranes acids diffuse most rapidly. When the feet are soaked in a tenth normal hydrochloric or sulphuric acid, the urine, which, as is well known, is slightly acid in reaction normally, becomes alkaline in five minutes, also scanty as to amount. In ten minutes the alkalinity is much more pronounced. If now the experiment is stopped, the alkalinity persists for three to five hours longer, gradually disappearing. An attempt to secure the

same results with citric acid failed, the urine showing, if anything, a slight increase of acidity. Even a half normal solution of citric acid produced the latter effect. When taken internally, the acids mentioned acidify the urine. Thus it appears that when, for instance, sulphuric acid is taken in through the skin quite a different physiological effect is produced from that found when the acid is taken into the digestive tract.

The work demonstrates clearly that living membranes act differently osmotically from dead ones, and that different living membranes may act very differently indeed toward some substances and yet much the same toward others. Whether a substance will be absorbed or not depends upon its specific nature and that of the membrane. The results of the experiments are a step forward toward a better understanding of the processes of absorption and secretion.

On the Refractive Indices of Absolute and of Aqueous Alcohol: Launcelot Andrews.

Absolute alcohol prepared by the use of calcined marble has the same density, the same refractive index and the same critical temperature of solution as that which has been dried by the use of metallic calcium or of magnesium amalgam.

The observations of Caismer to the effect that the critical temperature of solution of absolute alcohol in kerosene is the best criterion of the dryness of alcohol is fully confirmed.

Absolute alcohol was found to have the following constants:

Density	25°/40°	0.78510	0.00002
Zeiss immersion refractometer,		85°.30	0.02 at 25° H
Index of refraction		1.35941	0.00002 25° H

A table is presented, showing the refractive indices by the Zeiss immersion refractometer readings of aqueous alcohols for each per cent. of water from 0 to 30.

It is shown that aqueous alcohol has a maximum refractive index of 1.363315 0.000010 at 20.7 per cent. of water, corresponding to the formula.

On the Refractive Indices of Ether Alcohol Mixtures: Launcelot Andrews.

It is in general possible to determine the concentration of the solution of an organic substance in an organic solvent more rapidly by an observation of the refraction index than by the density. This is eminently so when the observation is made by the Zeiss immersion refractometer, which is frequently possible when the solvent is ether, alcohol or especially methyl alcohol.

Having occasion to determine the ether content of the mixtures named in the title by wholesale, a table was constructed showing the Zeiss constants for mixtures of absolute ether with aqueous (91 per cent.) alcohol, over the range from 100 to 84 per cent. of ether.

This table is given in the paper, together with a description of the experimental work on which it is based.

The Latent Heat of Vaporization of Methyl Silicate: Louis Kahlenberg and Robert Koenig.

Methyl silicate was prepared by treating silicon tetrachloride with absolute methyl alcohol. The pure product was found to possess a latent heat of vaporization of 46.48. Its specific heat between 23° and 115° C. was found to be 0.5011. The liquid boiled at 121° C. under 750 mm. pressure. The latent heat of silicon tetrachloride was redetermined and found to be 36.1. The value determined by Andrews was 37.3. The specific heat of silicon tetrachloride was found to be 0.1904 between 40° and 25° C. This agrees well with the value found by Regnault.

Equilibrium in the System Silver Nitrate and Pyridine: LOUIS KAHLENBERG and ROBERT K. BREWER.

The entire curve of equilibrium was determined from the freezing point of pyridine −48.5° to 110° C. From −65°, the freezing point of the saturated solution to −24° a solid of the composition $AgNO_3 \cdot 6C_5H_5N$ is in equilibrium with the solution. From −24° to +48.5° the solid in equilibrium with the solution is $AgNO_3 \cdot 3C_5H_5N$. From +48.5° to +79°, $AgNO_3 \cdot 2C_5H_5N$ is in equilibrium with the solution; and above the latter temperature pure $AgNO_3$ is in equilibrium with the solution.

Note on the Solubility Product: JULIUS STIEGLITZ.

Arrhenius's work (*Zt. phys. Ch.*, XXXI., 197) on the solubilities of silver salts of the fatty acids in the presence of sodium salts of the same acids destroyed the last vestige of the theoretical foundation of the solubility product constant by showing that the solubility C_{mol} of the non-ionized salts is not a constant, but decreases with the increased concentration of salt solutions. A decreasing molecular solubility C_{mol} and an increasing value for $C' \times C/C_{mol}$ as is found for strong electrolytes is consistent with a constant solubility product $C' \times C$ and the author shows that satisfactory constants are obtained for each of the silver salts by calculation from the data of Arrhenius. Such a constant, even if only an empirical and not a natural constant, is of great practical value in work on solubilities.

Two New Methods of Determining the Secondary Ionization Constants of Dibasic Acid: HERBERT N. MCCOY.

1. The concentration of the free acid in an aqueous solution of the normal and acid sodium salts of a weak dibasic acid is found by partition with an immiscible solvent. Titration of the aqueous solution gives the remaining data for the calculation of the ionization constant of the second hydrogen ion.

2. This same constant may also be calculated from the values of the equivalent conductances of very dilute solutions of the normal salt and the acid salt. The results of the two methods agree with one another and also with those obtained by other methods as well as could be expected.

The Preparation of Urano-uranic Oxide and a Standard of Radioactivity: GEO. C. ASHMAN and HERBERT N. MCCOY.

Pure UO is obtained by igniting pure uranyl oxide in an electric muffle at 650 to 700° C. At much lower temperatures decomposition is incomplete, at higher temperatures oxygen is slowly lost. Standards of radioactivity consist of films of the oxide UO about 40 sq. cm. in area and 0.7 to 0.9 g. in weight, deposited by a special process, on flat, circular plates of copper. Films so made having equal area, have identical activity. The ray activity due to 1 sq. cm. of such a film is taken as the unit of radioactivity.

The Three Component System—CuO, SO_3, H_2O *at 25 Degrees:* J. M. BELL and W. C. TABER.

Purified copper oxide or copper hydroxide was added in excess to a solution of copper sulphate, and the solid and liquid phases analyzed for copper and sulphuric acid after the system had come to equilibrium. In plotting the results on a triangular diagram, by joining the corresponding points of the solid and liquid phases, it was found that the lines did not meet within the triangle, indicating that the solid phases consist of a series of solid solutions, and are not definite chemical compounds of the nature indicated by the

formulas, $5CuO \cdot 2SO_3 \cdot 5H_2O$ and $4CuO \cdot SO_3 \cdot 4H_2O$, which have the best status in the literature of the basic sulphates of copper.

When sulphuric acid was added in excess to solutions of copper sulphate, the lines joining the corresponding points representing the solid and liquid phases pass through points representing the penta-, tri- and mono-hydrates of copper sulphate. At still greater concentrations of acid the anhydrous salt is the stable solid phase. The vapor pressure at which any two of these hydrates exist at 25 degrees, as found by Lescoeur and others, agrees well with the calculated vapor pressure of the solution at the corresponding invariant points.

The Action of Nitric and Citric Acid Solutions upon Ferric Hydroxide: F. K. Cameron and W. O. Robinson.

At 25° nitric acid dissolves a little more than its own equivalent of ferric oxide with the formation of a definite solid solution of ferric oxide, nitric acid and water.

From concentrations of nitric acid from 30 to 45 per cent. N_2O_5 the 18-hydrate of the normal salt exists. In a metastable condition it exists to a concentration of 55 per cent. N_2O_5. The stable solid from concentration 45 per cent. to 55 per cent. N_2O_5 is an acid salt of the formula $Fe_2O_3 \cdot 4N_2O_5 \cdot 2OH_2O$.

Oxalic acid dissolves more than its own equivalent of iron oxide at 25° with the formation of a solid solution of oxalic acid, ferric oxide and water.

The Rate of Diffusion of Oxygen through Organic Liquids: G. B. Frankfurter and G. W. Walker. Reported by title.

The Casting of Zinc: W. D. Bancroft. Reported by title.

Solution in a Dissolved Solid: Charles L. Parsons. Reported by title.

Reversed Electrolysis: J. W. Turrentine. Reported by title.

Principles Involved in the Construction of College Laboratories: Charles Baskerville. Reported by title.

The Heat of Ionization and the Reversible Potential of Nickel: E. P. Schoch. Reported by title.

Agricultural, Sanitary and Food Chemistry Section

W. D. Bigelow, Chairman

Determination of Sulphites in Food Products: Edward Gudeman.

Paper recommends the use of steam for distillation of sulphurous acid. Acid solutions of food products on concentration or during distillation are liable to be decomposed and sulphur compounds naturally found in the products, distilled over and oxidized and reported as sulphites or sulphurous acid present. Method of using steam prevents such concentration and decomposition. Results reported on fresh meats, gelatine and eggs. Advantages of method that distillate can be directly titrated with iodine solution for sulphurous acid, no danger of bumping or frothing of solutions and no decomposition of products due to concentration of acid solutions. Description of apparatus used for distillation.

Natural and Modified Starches; An Introduction to a Comparative Study of their Physical and Chemical Properties: Chester B. Duryea.

The author outlines an effort to decide whether or not starches are essentially homogeneous chemically. Modified starch is defined. Various methods of preparation are given, and also the more conspicuous phenomena resulting from the "in suspension" and "drying in" processes, which are stated to differ in their effects on the granules because of stratification conditions. Opposing elements in old views involving chemical homogeneity

of the granules, and the new hypothesis of the fundamentally different components amylopectin and amyloses are set forth. Objection is made to the indirect methods of previous investigators. The author's scheme of experimentation is explained in detail, and general reference is made to results so far had, which indicate that the new amylo-pectin hypothesis is untenable. The investigation in detail will be published later.

Note on the Dyer Method for the Determining of Plant Food in Soils: FRANK T. SHUTT and A. T. CHARRON.

The authors have submitted the results of an investigation of the influence of time of digestion and the influence of volume as related to the Dyer method for determining plant food in soils. From the results there is every reason for adherence to the time and volume limits as given by Dyer in his original account of the process.

A Recent Analysis of Water from Great Salt Lake: W. C. EBAUGH and KENNETH WILLIAMS.

From analyses made in this laboratory we know that the water of Great Salt Lake has varied widely in composition during the last twenty years, as indicated by the following partial results.

Year	Density at 15° C.	Per cent. by Weight, Total Solids
1885	1.1225	16.716
1903	1.2206[1]	27.721[1]
1907	1.1810	22.920

The solids contain the following constituents:

	Per cent. by Weight of Sample	Grams per Liter
Chlorine	12.67	149.633
Sulphate radical ..	1.53	18.069
Sodium	7.58	89.520
Potassium	0.72	8.503
Magnesium	0.45	5.314
Calcium	0.04	0.508
Total solids (direct determination) ..	22.92	270.675

[1] Greatest density ever recorded.

The Precipitation Method for the Estimation of Oils in Flavoring Extracts and Pharmaceutical Preparations: CHARLES D. HOWARD.

The author proposes a modified precipitation method for determining oils in flavoring extracts and this modified form yields very accurate results. No correction for oils retained in solution is necessary, alcoholic solutions are not detrimental except for almond oil. A determination may be made in less than ten minutes.

Effect of Lime and Gypsum on the Solubility of Potassium in Feldspars: F. W. MORSE and B. E. CURRY.

Lime and gypsum in contact with feldspar increases the solubility of potassium. This effect has not been detected when ordinary clay soils are treated in a similar way. This difference is probably due to the absorbing action of the clays which causes the removal of potassium from solutions.

A Study of the Changes Taking Place in the Muscle of Chickens when Preserved at Low Temperatures: M. E. PENNINGTON and E. Q. ST. JOHN, Food Research Laboratory.

The muscular tissue of chickens kept in a solidly frozen condition, at 13° F., shows marked histological changes even after one month in cold storage. These changes are progressive and at the end of six months many muscle fibers are scarcely recognizable.

The observations have been made on chickens of known history and which have been carefully kept, and upon chickens of the ordinary market type. The latter have been examined after storage periods of two and three years, as well as when stored for comparatively short lengths of time.

Methods of Soil Toxicology: OSWALD SCHREINER and EDMUND C. SHOREY.

The presence of small amounts of toxic

organic bodies in soils demands methods for their detection, isolation and study. Their presence and toxic properties are determined by physiological methods in which plants are employed. The isolation and identification must be done by chemical methods, employing the methods of toxicology and of biological and organic chemistry. The authors outlined methods of separating the organic matter from the large mass of inorganic material, and further separation of the pure organic body from the extraneous organic matter by methods of extraction, solution, precipitation, distillation, etc. The specific methods by which several harmful organic compounds have already been isolated from unproductive soils were given to illustrate the general principles involved.

Nitrates as Soil Renovators: Oswald Schreiner and Howard S. Reed.

Attention is called in this paper to an action of nitrates in aiding the destruction of harmful organic bodies which may be present in unproductive soils. After nitrates have acted in such a soil or soil extract, the conditions for plant growth are improved, although the nitrates have been used up by a previous crop. Roots of plants possess a strong oxidizing power and it has been found that this power is greatly augmented by nitrates, so that the oxidizing power under such conditions becomes sufficiently great to destroy harmful organic bodies, resulting in improved conditions for plant growth. When known toxic bodies are used in the experiments, their destruction by the plant and nitrates can be shown by chemical analysis.

The Proteids of Cotton: H. C. White.

This paper presents the results of the first of a proposed series of observations upon the nitrogen feeding of the cotton plant. During the season of 1907 analyses were made of pot-grown and field-grown plants, from sprouting to maturity, to determine the extent and character of the nitrogen compounds. The actual nitrogen content, at comparatively short intervals of growth, is shown and some valuable suggestions gained on which to base future studies of the development of the nitrogen compounds. The investigation will be continued through the coming season.

The Volatilization of Certain Mineral Elements in Ashing Plant Materials: W. W. Skinner, U. S. Department of Agriculture.

The usual method for determining the mineral matter in plants has been to ash the material and submit the ash to a complete mineral analysis; this presupposes that all of the mineral elements in the plant are retained in the ash, an assumption which for a long time has been known to be incorrect.

This work was undertaken to show to what extent sulphur, phosphorus, chlorin and potash are lost by the ordinary method of incinerating in air, and to point out the possibility of faulty conclusions resulting from the attempt to establish the relation of plant growth to the mineral elements in the soil from ash analyses which do not show all of a certain mineral element in the plant, a portion of it being volatilized in the process of ashing.

This paper gives results upon sulphur only, and shows the loss when ashed by the ordinary method as compared with the total sulphur obtained by the peroxide and the combustion in oxygen methods.

Analyses are given of two samples of cotton seed meal, two samples of mustard seed meal, three samples of malt, four samples of barley and three samples of wheat. The loss of sulphur varies from 89 per cent. to 97 per cent.

The Occurrence of Copper in Oysters: J. T. Willard.

Illness having followed eating oysters of a decidedly bluish green color, an analysis disclosed the presence of copper to the extent of 0.212 per cent. of the dry substance in one instance. Other tests of fresh and canned oysters on the Kansas market showed copper to be present in every case. Twenty-six samples from various localities were secured directly from the shells, and copper found in every instance, the average amount in the dry substance being 0.059 per cent. Copper seems, therefore, to be a normal constituent of oysters, and it is probable that some individuals may be affected by it when present in the larger amounts.

Influence of Fertilizers upon the Composition of Wheat: HARRY SNYDER.

Nitrogen, phosphorus, and potassium containing fertilizers, singly and in combination, were applied to wheat, and complete proximate analyses were made of the crop, and a study was made of the influence of the nitrogenous fertilizers upon the amount and form of the nitrogenous matter in the wheat. Milling and technical tests were also made of the wheat, and bread-making tests of the flour. Over forty samples of wheat were included in the investigation. The results show that an increase in nitrogen content of wheat can be secured by the use of nitrogenous fertilizers, but that the additional nitrogen is not all in the form of gluten proteids, a portion of the nitrogen being in the form of amides, nitrates and allied forms. The influence of the fertilizers upon the commercial and bread-making value of the wheat is also briefly discussed. In general an improvement in the quality of the grain was secured by the use of fertilizers.

The Detection of Formic Acid in Food Products: A. G. WOODMAN and ALBERT L. BURWELL.

The authors have obtained very satisfactory results in detecting formic acid used as a food preservative by means of a method based on the dry distillation of calcium formate.

The method used may be described briefly as follows: Fifty grams of the sample are mixed with 20 c.c. of 20 per cent. phosphoric acid and distilled by steam.

To the distillate is added 2 c.c. of 30 per cent. acetic acid free from formic acid, and about 20 c.c. of milk of lime (100 grams CaO per liter). The solution is evaporated to small bulk over a free flame and then on the water bath to dryness.

The dry residue is scraped into a test-tube provided with a cork and bent delivery tube and subjected to dry distillation. After the delivery tube has been allowed to drain, 3 c.c. of standard fuchsin aldehyde reagent is added to the distillate, the mixture allowed to stand exactly five minutes and compared with a standard color.

The fuchsin-aldehyde reagent is prepared by dissolving 0.2 gram rosaniline in 10 c.c. of freshly prepared *saturated* sulphurous acid and allowing the solution to stand until the red color has entirely disappeared and only a light straw tint remains. This is diluted with 200 c.c. of distilled water.

An Electrically Heated Polariscopic Tube: B. H. SMITH.

The tube consists of a fairly heavy inner tube of brass or other metal of one half inch inside diameter, the ends of which are threaded and capped as in the case of the usual form of polariscopic tube. An aperture, equally distant from either end, is threaded to receive a short wide-mouthed tube at right angles, which admits the thermometer. The latter tube, being removable, as is also the binding screw, allows a metallic jacket to slip over and protect the resistance wire. A short

cylindrical sleeve of this jacket fits a groove of the thermometer tube in such a manner as to prevent the possibility of any water getting to the windings. The wire, which is of german silver of 8/1,000 diameter, is put on in layers which are protected from the metallic inner tube and each other by asbestos paper or sheets of mica.

When properly wound, the tube heats up uniformly, the temperature being readily controlled by means of a small rheostat.

The Effect of Temperature on the Respiration of Apples: Fred W. Morse.

The author finds the amount of CO_2 exhaled at 10° and 20° to be respectively about two and four times the amount exhaled at 0°. This follows the laws of reaction velocity in this respect.

Some Notes on Soil Acidity: Fred W. Morse and B. E. Curry.

The authors report the reactions taking place between a number of clays and some common salts. Also some reactions between the organic matter in soils and some common salts.

The Relation between the Effects of Acid in Nutrient Solutions, and of Liming: Burt L. Hartwell and F. R. Pember.

Field experiments have shown that rye and barley, among the common cereals, are very differently affected by applications of alkaline material. Under conditions resulting in no benefit to rye, liming may increase the yield of barley, 100 to 200 per cent. Comparative water cultures[2] were carried on principally with rye and barley seedlings, to see if the addition of acid to the nutrient solution would affect the barley more injuriously than the rye, as might be surmised from the greater susceptibility of the barley to those conditions which are improved by liming. It was shown by repeated experiments that barley was *not* injured more than rye by the addition of acid. Growth in the case of both cereals was scarcely affected by an initial acidity equal to $N/5{,}000$, even though the nutrient solution was changed every few days during the three to four weeks of the experiments. A depression of about 20 per cent. occurred, however, when the acidity equaled $N/2{,}500$. An increase in the acidity to $N/1{,}700$ and $N/1{,}250$, decreased the green weight about 40 and 60 per cent., respectively.

The growth was not materially influenced by any degree of alkalinity which was insufficient to cause precipitation from an ordinary nutrient solution.

The Partial Substitution of Potassium by Sodium as a Plant Food: B. L. Hartwell, H. J. Wheeler and F. R. Pember.

The possibility of an indirect action of sodium in experiments with soil which have been conducted in Rhode Island and elsewhere, precludes an absolute proof of a *direct* beneficial action of sodium upon the growth of plants. This fact led to the growing of wheat seedlings in solution[3] and to the results which are briefly mentioned here. When the seedlings were grown in a nutrient solution containing an optimum amount of potassium there was no increased growth caused by the addition of sodium. When, however, the amount of potassium was reduced so that a depression in growth of about thirty per cent. occurred within a period of about three weeks, the substitution of an amount of sodium equivalent to the potassium which was withheld, caused about a ten per cent. greater growth than when the deficient amount of potassium, but no sodium, was present. An extra amount of calcium did not cause the increase which was produced

[2] Ann. Rpt. Agr. Expt. Sta., **20**, 358–380 (1907).

[3] Ann. Rpt. Agr. Expt. Sta., **20**, 299–357 (1907).

by the sodium: this fact and others indicate that the increase was not due to greater osmotic pressure. An addition of potassium or sodium increased the transpiration less than the green weight. When supplemented by sodium, a larger amount of potassium was left in the solution by the growing seedlings, showing that sodium was a conserver of potassium.

A Study of the Chemistry of the Chinese Edible Bird's Nest "Neossin": E. V. McCOLLUM.

"Neossin" is a glucoproteid. It gives Millon's, Adamkiewicz's, the biuret and xanthoproteic reactions. It contains 2 per cent. of sulphur, 9.69 per cent. of nitrogen and no phosphorus. Hausmann's method showed the nitrogen to be distributed as follows: NH_3, 1.3 per cent.; Humus, 1.27 per cent.; Phosphotungstic acid precipitate, 1.59 per cent.; Amino acids, 5.53 per cent. The substance is remarkable in that about one fourth of its sulphur is liberated as SO_2 when the proteid is hydrolyzed with 3 per cent. HCl. No sulphites are present in the nest. The gas was washed with $CuSO_4$ solution and gave no evidence of hydrogen sulphide. The mercaptan sulphur test is very faint.

When boiled with 3 per cent. HCl, the carbohydrate group is readily split off. The hydrolysis solution was precipitated with phosphotungstic acid and the filtrate used for the estimation of the sugar by Fehling's solution. It showed the presence of 15 per cent. of sugar calculated as glucose in the sample. This solution gave an osazone which melts at 183°–185° C. and has the composition of a hexosazone.

Arginine and histadine were identified in the phosphotungstic precipitate. Lysin appears to be absent.

The Importance of the Publication of a General Bulletin giving the Results of Food and Drug Work in the United States: E. H. S. BAILEY and H. L. JACKSON.

It would be a great advantage to those who have to do with the enforcement of food and drug laws if the results of analyses and opinions in regard to certain specific articles of food upon the market were published monthly in some general bulletin. It is of course true that articles might be passed in some states and condemned in others.

This difference might be due to the absence of laws in one state that have been enacted in another. Here the tendency would be to induce manufacturers to raise the grade of goods so as to make use of a common label for all states.

There might be a difference on account of the various methods of examination. If attention is called to this fact there would be thus an opportunity to work out better methods and so obtain more uniform results.

There might also be a different judgment regarding what foods are injurious or otherwise in the separate states. Here again a comparison of results would lead to investigations such as are now being carried on by the Department of Agriculture.

It is suggested that in addition to an official list of laboratories where food and drug analyses are made, there might be a list compiled under various headings, such as flavoring extracts, beverages, etc., giving those that are reported by municipal and state laboratories as being illegal, with a simple statement as to the reason why they are so considered. Although it probably does not come within the province of the federal government to issue such a bulletin, if it could be published in some other way, it would be extremely convenient to those who are engaged in food and drug work.

Extracting Sugar from Dried Beet Cossettes: Harry McCormack. Reported by title.

Analyses of Grains and their Comparative Value for Feeding Purposes: Joseph S. Chamberlain. Reported by title.

Changes taking Place in Whisky stored in Wood: C. A. Crampton and L. M. Tolman. Reported by title.

Detection of Thickeners in Ice-cream: G. E. Patrick. Reported by title.

INORGANIC CHEMISTRY SECTION

A. W. Brown, Chairman

Rapid Electroanalysis without Rotating Electrodes: Francis C. Frary.

The apparatus described by the author in the November number of the *Journal of the American Chemical Society* (p. 1592) was shown in operation and its construction explained. The object of the apparatus is to provide efficient stirring of the electrolyte during the progress of an analysis without the use of an electric motor or mechanical stirring device. The stirring effect is produced by the action of a magnetic field upon the solution while the latter is being electrolyzed. Two forms of the apparatus were shown, one for use with a wire gauze cathode and the other for a mercury cathode. Details of the construction of the apparatus may be found in the above-mentioned publication.

A Gas Volumeter with Table of Calculated Values for Carbon Dioxide: S. W. Parr.

An apparatus combining in one piece the advantages of various forms for evolving and measuring various gases from solids or liquids. The chief feature of the paper is intended to point out the errors existing in values now found in all texts of reference for carbon dioxide varying from 0.3 per cent. to 3.5 per cent. in amount. A corrected value with calculated table for various temperatures and pressure is proposed.

Atomic Weight of Chlorine: Wm. A. Noyes and H. C. P. Weber.

A new determination of the ratio between hydrogen and chlorine has been carried out, partly because of the very great importance of the atomic weights of silver and chlorine as a basis for the determination of other atomic weights, and partly because the work could be performed with the use of hydrogen from the same apparatus which was used in the recent determination of the atomic weight of H by one of us. The hydrogen was weighed absorbed in palladium. The chlorine was weighed in the form of potassium chloroplatinate, and the hydrochloric acid was weighed in the first series by absorption in water and in the second series by absorption in water after first condensing it to the solid state by means of liquid air. The ratio found is $H:Cl = 1:35.184$. This, by combination with the recent value for the atomic weight of hydrogen, determined by one of us, gives the atomic weight of chlorine as 35.461 and the atomic weight of silver as 107.88.

An Yttrium Group Separation Method: Benton Dales and H. D. Young.

The scheme is to dissolve fractionally the rare earth hydroxides in solutions of ammonium salts of organic acids. One series of fractions obtained by the use of cold saturated ammonium acetate solution with material of atomic weight 108 (mostly yttrium, but containing also nearly all the rest of the members of the group) gave five fractions of atomic weights 128, 124, 109, 104, 105. These values are round numbers obtained by the use of a modification of Herrmann's hydrochloric acid titration method. A first fraction contains practically no rare earths, for some reason unknown at present to the authors. The same

material as acetates dissolved fractionally in ammonium acetate solution yielded two fractions of atomic weights 125 and 106.

Sodium Peroxide in Certain Quantitative Processes: S. W. PARR.

Fusions by means of sodium peroxide in a closed chamber are shown to have positive advantages in the analysis of substances represented by the following groups. Sulphur and arsenic in pyrites, both iron and copper; sulphur in coal, coke, ashes, etc.; sulphur in rubber, filters and rubber substitutes; halogens, sulphur, arsenic, etc., in organic compounds, especially intended to replace the carius method; silicon and carbon in carborundum.

The Decomposition of Ores and Metallurgical Products by Means of Sodium Peroxide and Certain Metallic Sulphides: J. H. WALTON, JR., and A. SCHOLZ.

By mixing certain ores with sodium peroxide and metallic sulphides such as precipitated zinc sulphide, and igniting the mixture, sufficient heat is liberated to completely decompose the ore. The fusion is carried out in a small nickel crucible. It takes place quietly, the decomposition is rapid and the crucible is attacked to an inappreciable extent only.

The method has been used for the decomposition of galena, chrome iron ore, manganese ores, slags, clays and glazes. The results agree closely with those obtained when the standard methods of decomposition are used.

The Occurrence of Neon in Natural Gas: H. P. CADY and D. F. MCFARLAND.

The rare element neon has been found in natural gas from southeastern Kansas, along with helium. It is separated in pure condition by fractional absorption in bulbs filled with cocoanut charcoal and cooled with liquid air.

The neon is identified by careful measurement of the lines of the spectrum and comparison with best published measurements. All of the stronger lines have been identified. Besides the lines of neon fifteen fairly strong lines are found which can not be identified as belonging to any of the familiar gases.

These same lines have previously been reported by Dewar in the spectrum of the gas from Bath Springs and also in lists of the lines shown by the more volatile gases from the atmosphere. It is possible that these may represent a new elementary gas.

A Discussion of Methods in Use for Separations in the Group and a Description of a New Method of Separating these Earths by Use of their Succinates: V. LENHER.

Dilution of the Strong Acids and of Ammonium Hydroxide: C. W. FOULK and H. E. SURFACE.

The authors have prepared tables for sulphuric, nitric and hydrochloric acids and for ammonium hydroxide which give in addition to the usual percentage composition and specific gravity the volume of water to be mixed with one liter of the strong reagent to give a mixture of a called-for specific gravity.

The Character of the Compound formed by the Addition of Ammonia to Ethylphosphoplatino Chloride (second contribution): CHARLES H. HERTY and R. O. E. DAVIS.

Further efforts to prepare the completely ionizable chloride described by Rosenheim have proven fruitless. Slight variations from Rosenheim's directions were likewise failures. In every case only that chloride was obtained containing one ionizable chlorine atom. The constitution of this latter compound is in strict accord with Werner's coordination hypothesis.

The Influence of Temperature on the Electrolytic Precipitation of Copper from Nitric Acid: James R. Withrow.

In determining copper in presence of nitric acid by the older electrolytic methods (without agitating the electrolyte) it was found upon a number of occasions that the nearly complete deposits would disappear from the cathode.

The trouble was traced to accidental fluctuations in the temperature. Copper dissolves in nitric acid more readily at elevated than at ordinary temperature. Therefore, if the current strength is sufficiently low the solvent influence of rising temperature soon exceeds the ability of the current to deposit the metal.

The rate of electrolytic precipitation of copper was, therefore, determined at a number of temperatures, using a current of low intensity, so as to find just what this temperature effect was. Preliminary to this, however, it was necessary to determine the rate of precipitation from varying amounts of nitric acid. The most favorable amount of acid was then used in the elevated temperature experiments.

It was found that nitric acid increasingly retards precipitation even from the smallest amounts upwards. The use of small quantities, however, is advantageous because of the beneficial effect on the character of the deposits.

Using 0.2 per cent. (by volume) of nitric acid, it was found that increasing temperature accelerated the precipitation until 60° C. was reached. Beyond 70° C., however, the influence was a retarding one. This "turning temperature" will of course vary with the current strength.

Action of Certain Oxidizing Agents upon Hydrazine Sulphate: F. F. Sheterly. Reported by title.

The Electrolytic Formation of Selenic Acid from Lead Selenate: F. C. Mathers. Reported by title.

The Reaction Produced by Heat upon a Mixture of Ammonium Chloride and Potassium Bichromate: G. B. Frankforter, E. V. Manuel and V. H. Roehrich. Reported by title.

Action of Water on Galvanized Iron: W. F. Monford. Reported by title.

The Preparation of Silicon Tetrachloride: Charles R. Sanger. Reported by title.

The Preparation and Properties of Pyrosulphol Chloride and Chlorosulphonic Acid: Charles R. Sanger. Reported by title.

Recent Improvements in the Determination of Small Amounts of Arsenic and Antimony: Charles R. Sanger. Reported by title.

The Determination of Small Amounts of Fluorine: Charles R. Sanger.

Sodium Alum: W. R. Smith. Reported by title.

Some New Compounds of Hydrazine: J. W. Turrentine. Reported by title.

Fractionation of the Yttrium Earths: R. D. Hall. Reported by title.

The Rare Earth Bromates—A New Method of Separation of the Yttrium Earths: Charles James. Reported by title.

A Scheme for the Separation of the Rare Earths: Charles James. Reported by title.

A Study of Graphitic Acid: G. B. Frankforter and Lillian Cohen. Reported by title.

B. E. Curry,
Press Secretary

(To be continued)

SCIENTIFIC BOOKS

A History of Chemistry. By ERNST VON MEYER, translated by GEORGE MCGOWAN. Third English edition. New York, The Macmillan Co. 1906. Pp. xxvii + 691.

Vortraege über die Entwickelungsgeschichte der Chemie. By A. LADENBURG. Fourth German edition. Braunschweig, Vieweg und Sohn. 1907. Pp. xiv + 418.

A History of Chemistry. By F. P. ARMITAGE. New York, Longmans, Green and Co. 1906. Pp. xx + 266.

A History of Chemical Theories and Laws. By M. M. PATTISON MUIR. New York, John Wiley and Sons. 1907. Pp. xx + 555.

Abhandlungen und Vortraege zur Geschichte der Naturwissenschaften. By EDMUND O. VON LIPPMANN. Leipzig, Veit und Comp. 1906. Pp. xii + 590.

"Man is an animal that looks before and after," but the chemist is, of all men, the one who is most in danger of being so impressed by the activity of to-day as to find little time for looking backward. Yet the greatest chemists, almost without exception, have been students of the history of the science and in many instances their historical reading has influenced strongly the direction and even the quality of their work. It is true that the best source of inspiration is the reading of the original documents, but well-ordered general accounts of the development of the science, or of particular parts of it, are indispensable aids in the larger task, even if they can not replace it entirely. The works before us present the historical side of chemistry in different ways, and, far from being competitors, they supplement one another admirably. Von Meyer's is the most complete, but the mention of many things in very brief. Ladenburg covers much the same period but takes only the salient points. Armitage is briefer still, more highly colored and more lively. Muir follows only certain lines in the development of the science, but in these lines is fuller than von Meyer. Finally, von Lippmann provides us with a series of intensely interesting studies. He deals with single points or with the work of a particular man, and his subjects are as often in physics, or even literature or philology, as in chemistry.

The first and second editions of von Meyer's "History" have already been reviewed in SCIENCE, and its breadth and accuracy of treatment, the fullness of its references to sources of historical information, and the simplicity and directness of its style are well known to every chemist. Since the appearance of the first German (1888) and English (1891) editions the science has been advancing with ever-increasing strides and it has been becoming more and more difficult to disentangle from an overwhelming mass of facts the leading ideas of which these facts are in some sense the fruit. The author has endeavored to recognize these advances by means of special histories of each branch of the science, which follow the main history. In these, after a brief résumé of the main connections with the earlier history, already discussed in detail, he endeavors to trace the growth down to the date of the present edition. In this he is surprisingly successful, when the herculean nature of the task is considered.

The translator has done his work creditably, and the changes he has made, with the sanction of the author, are all useful. It is a pity, however, that these did not include the substitution of a reference to A. S. Couper's paper in the *Philosophical Magazine*, for the two French ones given in the German edition. If so many of our works on chemistry had not been borrowed from Germany, more of us would have escaped errors like that of trying to give a French pronunciation to the name of a Scotsman born in Kirkintulloch!

Ladenburg's "Lectures," which have reached their fourth German edition, are familiar in Dobbin's admirable translation. The period which they cover begins, practically, with Lavoisier, and the seventeenth lecture, prepared for the fourth edition, brings the book up to date. Evidences of the care with which the other sixteen lectures have been revised may be seen in almost every page. The lectures furnish a clear and interesting panorama of the progress of chemistry and hold

one's attention, without wearying it, from the first word to the last. While the work is not comparable with von Meyer's in size, yet, to the writer, the choice of material for illustration seems often to be happier. Perhaps no two chemists would make the same distribution of emphasis. But, in view of the theoretical and commercial importance of the work of Roberts Austen, von Jüptner, and Roozeboom on the allotropic forms of iron, for example, few would grudge the page which Ladenburg devotes to the matter, and hardly any chemist would side with von Meyer in ignoring these investigators and the subject entirely.

Armitage's "History" begins at the beginning, or perhaps even earlier. E. von Meyer starts with the Egyptians, but Armitage's opening sentence traces the science back to "the dawn of human intelligence." To make up for this unusual extension in one direction, the book stops rather unexpectedly with what the author might call the morning of the periodic system. Only a few pages, in an earlier chapter on stereo-chemistry, deal with anything later than this epoch. While the book is in some ways immature, it has distinct merits. Its vocabulary of breezy adverbs and adjectives, its rhetorical questions, and its semi-familiar way of interpreting the feelings, as well as the opinions, of the fathers of the science are an effectual antidote to the "dryness" which is apt to settle down on history.

> Berzelius, in reviewing the whole subject [of atomic weights], became oppressed with the unscientific, slapdash manner in which it had been approached by his contemporaries. Was there no general principle . . . which might guide one right in the choice of atomic weights from the many values submitted?

Quotations, brief and to the point, are introduced aptly, and the men are characterized successfully without waste of words. Taking it all in all, the book may be recommended to those who wish a brief and readable account of the men who have made chemistry, of how they made it, and of what they made it. It is too bad, however, that in a book by a Briton, poor Couper should be connected exclusively, and so explicitly, with a French journal, and should be made even more like a Frenchman than usual by an error in his initials—*M.* S. Couper!

Professor Muir's "History of Chemical Theories and Laws" does not profess to be a history of the whole science; to use the author's own words:

> The more I try to understand chemistry, the more I am convinced that the methods, achievements, and aims of the science can be realized only by him who has followed the gradual development of chemical ideas. . . . I have not attempted the uncalled for task of writing a history of chemistry. The object of this book is to set forth what seem to me the main lines along which the science of chemistry has advanced to its present position. . . . As the purpose of this book is to show how the main conceptions of chemistry have arisen, widened, strengthened, gained or lost ground, this purpose will be better served by taking changes in the general ideas of the science as the landmarks, than by arranging the history of the subject in chronological periods. . . . The development of chemical principles is regarded in this book from the position of to-day. The book is not an attempt to move through the past without knowing whereto the course of the science is tending.

It is, in a sense, therefore, a history of chemical philosophy, arranged so that one set of historically related conceptions after another is followed to its latest developments. The author's plan, of choosing certain lines, has the further advantage that his material is selected, and not, as in the general histories, in large measure thrust upon him by the mere fact of its existence. He is thus enabled to enlarge upon the topics and periods which interest him, and therefore to dwell upon them at such length that the interest of the reader has a chance to be thoroughly awakened also.

In the opening chapter, dealing with the ante-oxygen era, and in many places throughout the rest of the book, the author's well-known familiarity with and interest in the ideas of the alchemists and early chemists provide him with a fertile background and, later, aid him in maintaining the perspective as the work develops. The chemical reformation initiated by Lavoisier, with his recognition of the existence of distinct substances and

their constitution as either elementary or compound, the work of Dalton, and the differentiation of atom and molecule, with all the history which is implied by these phrases, occupy three long chapters. Three briefer chapters dealing with the extension of Avogadro's hypothesis to dilute solutions, allotropy and the inert elements, together with an appendix on nomenclature, complete the first part of the book. This part (200 pages) deals, therefore, with the evolution of the conception of the substance and of all that is connoted by the terms atom and molecule.

The second and longer part deals with chemical interaction in the broadest sense of the term. The first section of this part treats, in six chapters, of the classification of substances by their chemical properties, molecular structure as an expression of chemical behavior, and the periodic system as the basis of a formulation of both physical and chemical behavior. It includes also a chapter on ionization in solution and electronic ionization, with a full account of J. J. Thomson's corpuscular hypothesis of the constitution and behavior of atoms. The second section of this part deals with the conditions and laws of chemical change. In one chapter chemical affinity from Newton to Van't Hoff is reviewed. In another, chemical equilibrium is brought down to Ostwald's Faraday Lecture. In the last chapter the relation between chemical and optical properties, from Biot to Perkin, and thermochemistry from Lavoisier to Clarke, are treated with considerable fullness.

As the author says, others might have made a different selection of material—one misses, for example, the work of Werner when valence is discussed—but the selection is on the whole excellent. The feeling of growth and organic inter-relation is kept admirably before the reader. The style is attractive and the mode of presentation lucid and interesting. The book is not only suggestive, but highly readable—there is not a dry page in it. It is not mere book-making, either. Every statement is based upon a careful study of the original literature, and the scholarship of the book is worthy of the author and of the university with which he is connected.

Von Lippmann's "Addresses and other Contributions to the History of the Natural Sciences" is undoubtedly, in many ways, the most interesting volume of the set. It is a reprint, with slight alterations, of thirty-two addresses and articles, written during the past fifteen years, by the versatile director of the sugar refinery of Halle. They are not fugitive papers, but profound historical studies, and their permanent value—evident enough to the reader—is shown by the frequency with which they are quoted by other writers, like von Meyer. They are perfect mines of information and entertainment, and the thanks of all interested in science, and of chemists in particular, is due to the author and publisher for issuing the studies thus, in collected form. The longer articles include systematic surveys of the chemical knowledge of Pliny and Dioskorides, a history of gunpowder and firearms, an abstract and critique of Goethe's "Farbenlehre," and an analysis of Leonardo da Vinci's many-sided attainments, as a man of science and mechanics. In another, the author makes a searching inquiry into Francis Bacon's writings and mode of life, with a view to determining the exact measure of the profound knowledge often attributed to him and, incidentally, to settle the question whether, if Shakespeare himself lacked the education and scholarship shown in the plays, Bacon was, as some believe, the one man of that time who obviously had the requisite qualities, and might therefore have been their author. Just as in the earlier essays the author's extensive reading in Latin, Greek and Mediæval literature fills the reader with astonishment, so here his familiarity with English literary, scientific and philosophical writings is amazing. He quotes, in passing, Harvey's remark, that Bacon wrote, not like a scientific man, but like a Lord Chancellor, and cites Carlyle, Whewell, Mill and dozens of others with bewildering appositeness. The author is undoubtedly the Andrew Lang of science. This article leads naturally to another containing a systematic account of the scientific knowl-

edge found in the works of Shakespeare. The volume closes with a biographical and critical estimate of Descartes, and a similar account of Robert Mayer, his life, and the trials which he experienced in the promulgation of his views on energy.

The same wide knowledge of curious matters pertaining to science pervades the briefer articles, even the titles of which can not all be quoted. Saint Augustin on quicklime, the superstitions connected with the mandragora, the mystery of the "coasts of Bohemia" (Winter's tale), which is solved by a remark encountered while reading for his "History of Sugar," are all delightful. A note on Who introduced the experiment of burning of a watch spring in oxygen, shows that it was Jan Ingen-Housz (1730–1799), better known as the discoverer of the fact that plants breathe oxygen and generate carbonic acid, in addition to assimilating the latter as food. Amongst the other papers are interesting biographies of Marggraf and Achard, and a curious report on the profits which Edward Howard (brother of the Duke of Norfolk) derived from the invention of the vacuum evaporating apparatus. Several articles deal with subjects connected with sugar. But the author is more than a sugar-chemist and his book can be recommended most heartily to all who are interested in the history of science.

Alexander Smith
The University of Chicago

Die Zustandsgleichung der Gase und Flüssigkeiten und die Kontinuitätstheorie. Von Professor Dr. J. P. Kuenen in Leiden. Braunschweig, F. Vieweg und Sohn. 1907. Pp. x + 241.

Professor J. P. Kuenen, now at Leyden, and recently at University College, Dundee, is a man whose experience has peculiarly fitted him for the task of writing this book, as might be inferred from an examination of the book itself. The "equation of state" which was devised by J. D. van der Waals, of Amsterdam, in 1873, and which bears his name, is an equation which attempts to give in a compact form, the laws controlling the variations of volume, pressure and temperature of all gases, not only when they are far removed from the critical condition, but even at and near the critical point as well. It is usually written

$$(p + a/v^2)\,(v - b) = RT$$

where a, b and R are constants for any one gas, and p is the pressure, v the volume of unit mass, or specific volume, and T is the absolute temperature of the gas. This equation is a vast improvement over anything that preceded it, particularly the equation of so-called perfect or ideal gases, representing Boyle's and Charles's laws, and is a landmark in the history of physics, but it nevertheless does not represent the facts with complete success. It seems indeed as if it must always remain impossible to represent by one equation containing only a moderate number of constants, the complexity of real gases, for real gases are simple only when compared with liquids or solids, or when their complexities are overlooked, and we regard merely their most important characteristics. The equation has, however, been of marked service in showing the relation between different gases, and between various phenomena of gases, particularly those connected with their behavior when near the critical point, and when they depart most from the simple laws of ideal gases.

Professor Kuenen's book begins with a general statement of the phenomena attending the condensation of gases into liquids. He shows how the elementary kinetic theory of gases explains their behavior when far above the critical point. He then shows, following van der Waals, how this simple theory may be modified by a consideration of the finite size of the molecules of a gas and the forces of attraction which may exist between them. The equation of state having been obtained, it may be used to throw considerable light on the phenomena of condensation, conditions of unstable equilibrium, etc. Several chapters are devoted to what is perhaps the most important thing to be considered, the agreement between the equation and experimental facts. In these chapters are considered the law of corresponding states, critical constants, behavior at high pressure, saturation pressures, Joule-Kelvin researches, specific heats, etc.

The book also considers the various attempts that have been made to improve the equation of van der Waals, and the equations of state proposed by others. The last chapter gives the mathematical methods by which the equation of van der Waals may be deduced.

The book is a valuable monograph on the subject of which it treats and brings together a large amount of information that otherwise could be found only by a laborious search through journals. At the end of each chapter, and in footnotes, are given full references to the literature of the subject treated of in the chapter. At the end of the book there is an index of names but not of subjects. The need of a subject index is satisfied in part by a full table of contents in the front of the book. A book of this kind, however, has a valuable use as a reference book, and for such a use the lack of a good subject index is a serious shortcoming, which is felt keenly in proportion to the value of what the book contains. It is only a book to which no one wishes to refer that does not need a subject index. W. S. D.

Plant Anatomy from the Standpoint of the Development and Functions of the Tissues and Handbook of Micro-technic. By W. C. STEVENS. 8vo. Pp. xii + 349. With 136 illustrations. Philadelphia, P. Blakiston's Son & Co. 1907.

As is indicated by the title of this book, the standpoint adopted is the physiological one; in fact, the book might have been named Anatomical or Structural Physiology. The titles of many of the chapters indicate this, *e. g.,* Construction of the Plant's Food, Secretion and Excretion, and the general method of discussion is to describe the process, then the structures concerned. No doubt this is a useful standpoint, and the method of treatment is appropriate, but it seems a pity that the bearing of anatomy on the great problems of morphology should be altogether ignored. Since the book is in no sense a work on comparative anatomy, we find no reference to the structure of fossil plants.

Within the scope of 217 pages the author gives a clear though necessarily brief and elementary account of the main processes and structures of the so-called vegetative parts of a higher plant. The first three chapters describe the development of the tissues from the undifferentiated cell, through the stages of meristem, primary structure and secondary growth. In the main the account is clear and accurate as far as it goes, and is much aided by the carefully executed and elaborate diagrams which illustrate such features as the primary and secondary structure of stems. The diagrams throughout the book are in fact one of its most noteworthy and valuable features. The description of vascular bundles may be adequate from the author's standpoint, but it seems strange to see no reference to protoxylem, nor figures of amphicribral and bicollateral bundles. Several well-chosen "illustrative studies" conclude each chapter.

Protection from Injuries and Loss of Water and The Plant Skeleton are next considered. The treatment here is too brief and incomplete to give the student an intelligent idea of the important ecological adaptations which might be discussed under these heads. Loss of water through stomata is not treated here, as one might expect, but is deferred to a later chapter.

The absorption, circulation and storage of water, gases and foods are the topics discussed in chapters VI. to XI. By means of numerous ingenious diagrams the leading facts are presented in so lucid a way that he who runs may read. A possible exception to this statement may be found in Fig. 94, in which the perspective is faulty. Moreover, it may be questioned whether this diagram as well as some others does not try to show too much. Owing to the standpoint of the book we might expect to find under the heading of circulatory tissues some reference to Strasburger's brilliant discovery of the substitutes for companion cells in the phloem of *Pinus,* but instead of this we find the erroneous statement (p. 162): "In gymnosperms and vascular cryptogams the companion cells do not occur, and their place is taken by vertical rows of parenchyma cells." A series of illustrative studies concludes each chapter of this section.

A chapter on Secretion and Excretion con-

cludes the descriptive part of the book. In this as in other chapters extensive use is made of the classic work of Haberlandt.

The remaining 125 pages are devoted to the subject of technique and the micro-chemistry of plant products, added to which is an introduction to the study of adulterations in foods and drugs. The section on technique contains concise and clear directions for fixing, imbedding and staining, but unfortunately can not be regarded as up to date in all respects. Celloidin is undoubtedly the best imbedding material for the very tissues studied in this book, yet the author says "celloidin is to be looked upon as a last resort in a difficult situation." He says, moreover, "It is difficult to get sections as thin as ten mikrons." These statements can be easily accounted for by the celloidin method which he advocates and which has been greatly improved by Jeffrey. The method of applying the hematoxylin-safranin stain described on page 235 would be made more manageable by using the hematoxylin first, and improved by substituting Ehrlich's for Delafield's hematoxylin.

The chapter on reagents contains some useful recipes, and the directions are concise and to the point. A few inaccuracies occur, *e. g.*, on page 257 "vapor of sulphuric acid" evidently means sulphur dioxide. Further, it is not necessary to ripen aqueous solution of hematoxylin for two months, as stated on page 233.

In a general way the book has much to commend it. The freedom from typographical errors is agreeable ("gram" is printed "grain" on page 227), the typography is excellent, and the large number of new figures is refreshing. In this connection it is unfortunate that Vines's poor figure of a root should have been copied for Fig. 26. Reference has already been made to the diagrams, which are a distinct feature of the book. An index is provided, but the only hint of a bibliography is in the preface. A few terms of doubtful utility have been introduced, *e. g.*, the borrowing of the German word "Borke," and the use of "fixative" for fixing fluid.

To those who consider anatomy as an adjunct of physiology rather than the handmaid of phylogeny the book will form a valuable text for class use, and to all working botanists the book may well find a place on the laboratory shelf.

M. A. Chrysler

SCIENTIFIC JOURNALS AND ARTICLES

The American Naturalist for December contains "Preliminary Notes on Some American Chalicotheres," by O. A. Peterson, based on some fine specimens of *Moropus elatus* in the Carnegie Museum. The author concludes that *Moropus* is essentially a perissodactyl, save in its unguiculate feet, and that the evidence points to an European ancestry. Charles R. Stockhard presents some "Observations on the Natural History of *Polyodon spathula*." The fish has become of considerable importance for food and will probably soon be greatly reduced in numbers. It is fished for with seines running up to one and two miles in length, and on one occasion more than 150 barrels were taken at a single haul. C. H. Eigenmann reviews "Fowler's 'Heterognathous Fishes' with a Note on the Stethaprioninæ," noting that while certain genera and species have been well established new names have been added that in many instances are synonyms. William M. Wheeler discusses "Pink Insect Mutants," considering that they, as well as many brown individuals, are simply sports and belong in the same category as albinos.

Bird Lore for January-February contains articles on the "American Dipper in Colorado," by Junius Henderson; the Canada jay, "The Bird that Nests in the Snow," S. S. Stansell; "Redpoll Linnets," by Lottie A. Lacey; the second paper on "The Migration of Flycatchers," by W. W. Cooke, accompanied by a fine colored plate. There is a list of the members of "Bird Lore's Advisory Council," and "The Eighth Christmas Bird Census," representing the work of a large number of observers from Maine to Oregon, though mainly in the eastern states. In general birds are reported as scarce. The Audubon leaflet is devoted to the snowflake and it

is noted that a patrol boat has been placed on Lake Klamath, Oregon.

The American Museum Journal for February records the receipt of two specimens of the rare Haitian *Solenodon,* heretofore known from a single specimen sent to St. Petersburg in 1833. It is stated that only five specimens of the Cuban *Solenodon* have found their way to museums, but are there not more than this? There are notes on "An Archeological Reconnaissance in Wyoming" and on new or rare minerals added to the collection.

The Bulletin of the Charleston Museum for January contains the report of the director for 1907, which states that the main changes in the new museum building are nearly completed. An appeal is made for more funds, which are very much needed, not merely for the extension of work, but for the proper care and exhibition of material already in hand.

The Museum News of the Brooklyn Institute for February has articles on "Insects and Arachnids as Carriers of Disease," "Zuni Weapons and Hunting the Matamata." It notes the acquisition of the collection of shells made by the late Charles A. Dayton, which comprises 3,700 species. This with collections already received gives this museum an unusually fine series of mollusks. It is noted that the library has been moved to larger quarters in the new wing recently opened.

The *Plant World* for February opens with an article by Dr. G. H. Shull on the aims and methods of pedigree-cultures, in which a detailed description is given of the technique of pure-bred and sterilized cultures. The authors of various criticisms upon this method of study of heredity will be surprised to learn that such cultures not only do not isolate the species being tested, but bring numbers of nearly related forms into close proximity under conditions which permit their inter-reactions to be exactly estimated. Dr. D. T. MacDougal discusses the principal features of the problems in genetics and botany which may be attacked with greatest hope of success in the desert and the use of xerophytic forms. The structural and physiological relations of forms known as adaptations are being taken up basally at the Desert Laboratory and its mountain stations.

SOCIETIES AND ACADEMIES

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

THE 643d meeting of the society was held at Hubbard Memorial Hall on January 18, 1908, President Bauer in the chair. The meeting was devoted exclusively to hearing addresses commemorative of the life and labors of the late Lord Kelvin.

The first paper of the evening was entitled "Lord Kelvin, His Life and Works," delivered by invitation, by Professor Arthur G. Webster, of Worcester, Mass.

Dr. R. S. Woodward spoke of "Lord Kelvin's Contributions to Geophysics."

Professor Simon Newcomb told of "Lord Kelvin's Character and Personality."

By invitation, his excellency the British ambassador, Mr. James Bryce, favored the meeting with an interesting sketch of Lord Kelvin's life, bearing testimony to the simplicity of Lord Kelvin's character and the greatness of his wonderful mind.

The full text of the foregoing addresses are soon to be published as a part of *Bulletin* XV. of the Philosophical Society of Washington.

THE 644th meeting was held on February 1, 1908.

Professor C. F. Marvin gave a description of "A Universal Seismograph for Horizontal Motion," recently designed by him at the U. S. Weather Bureau. A full description of this instrument, prepared by Professor Marvin, is soon to appear in the *Monthly Weather Review.*

The second paper of the evening was presented by Professor Frank H. Bigelow upon "Relations of the Temperatures of the United States to Solar Radiation."

The natural synchronism between the variable action of the solar radiation and the terrestrial temperatures may be missed in an investigation in three ways: (1) The use of non-homogeneous data at the sun and at the

earth, (2) the application of analytic methods based on perfect periods for the solar variations which are only roughly periodic, (3) the omission to consider the important effects of atmospheric circulation upon the observed temperatures. The temperatures of the United States are very indirect functions of the solar radiation, depending upon transported heat more than upon direct radiation. Many years have been consumed in securing homogeneous data, but we now possess tables covering the interval from 1872 to 1905 for the solar prominence frequencies, the European horizontal magnetic force, the temperatures, vapor pressures and barometric pressures of the United States, comprising more than one hundred stations. The monthly means were in all cases computed from the daily values reduced to homogeneous conditions for the interval. This paper refers only to the variations of the annual means of the several elements, and these are separated into two portions by eliminating the short period ordinates of about three years from the long period ordinates of about eleven years. The result is approximately as follows: Referring to an earlier paper, it was shown there that the temperatures in the tropics vary directly, but in the temperate zones inversely, with the solar prominence frequencies, and that the pressures of the eastern hemisphere vary directly, but of the western hemisphere inversely, as a general rule. In this paper it is shown that these rules hold good in the United States, with certain local modifications due to the general circulation of the atmosphere. In the Pacific states the synchronism of the temperatures is direct, while east of the Rocky Mountains it is inverse. The eleven-year period is well defined in the Pacific States, but is nearly wiped out by the circulation east of the mountains. The three-year period persists in each district, but a partial inversion and a lag of a few months is indicated east of the Rocky Mountains. These and other similar results are the direct products of circulation, since the California district is really a part of the system of the tropics, because the high-pressure belt crosses the United States from Florida to Oregon, and thence passes southwestward. These inversions are naturally connected with the general circulation. An increase in solar radiation, inferred from an increase in the number of the solar prominences and the strength of the magnetic field, causes increase of temperature and circulation in the tropic zone, but a decrease of the temperature in the middle latitudes because the *return* currents from the polar zones bring an excess of cold high areas into the United States. The temperature for a given year in a given locality is due to the transported heat primarily, which rather remotely depends upon the prevailing radiation. Aside from the great difficulty of securing homogeneous tables of the solar radiation by observations with the pyrheliometer, on account of the difficulty of eliminating the local absorptions due to the meteorological conditions of the atmosphere above the station, it is yet more difficult to make allowances for the effect of circulation. The statistical method of recording the facts must be pursued without interruption for many years, and then this historical record will gradually build up laws which will have a practical value in seasonal forecasts. The U. S. Weather Bureau now possesses a set of homogeneous records covering one third of a century, and all its observations are now made so as to continue these synchronous data in a perfectly automatic manner.

R. L. Faris,
Secretary

The Chemical Society of Washington

At the twenty-fourth annual meeting of the Washington Section of the American Chemical Society, held at the Cosmos Club, Thursday, January 9, the following papers were read: "The Detection of Thickeners in Ice-cream," by Professor G. E. Patrick, and "The Three Component System CuO, SO_3, H_2O," by J. M. Bell and W. C. Tabor.

The following officers were elected:

President—Joseph S. Chamberlain.
First Vice-president—P. H. Walker.
Second Vice-president—G. H. Failyer.
Secretary—J. A. LeClerc.
Treasurer—F. P. Dewey.

The executive committee consists of the officers and the following gentlemen, who were also elected: E. T. Allen, A. Seidell, E. A. Hill and S. S. Voorhees.

W. W. Skinner was appointed chairman of the committee on communications.

J. A. LECLERC,
Secretary

DISCUSSION AND CORRESPONDENCE

IS ALABAMORNIS A BIRD?

A LITTLE more than a year ago Dr. Abel published a brief paper, taking the ground that the bones described by me in 1900 as the pelvic girdle of *Zeuglodon* were really the coracoids of a gigantic bird, possibly allied to *Gastornis* and, distantly, to *Anthropornis*. In reviewing this paper I said that it "seemed so clear and convincing that this conclusion was at once accepted, . . . but it became evident that if they (the bones) were the coracoids of a bird, that bird was extraordinary, if not exceptional in many particulars"; it was therefore decided to say nothing more until the bones could be reexamined. It has been impossible for me to do this, but Mr. C. W. Gilmore has kindly examined them for me and corroborated my remembrance of certain details. It is rather difficult to discuss the question without figures, but a description of the bones taken by me for ossa innominata must suffice for the present. One is perfect, save for the loss of a few millimeters on one process; the other has lost the posterior, or proximal, end if it is a coracoid, but the anterior end is perfect, which in this case is an all-important fact. Close by the anterior end is a good-sized cavity, precisely like an acetabulum, and this is *the only articular surface* present; what Dr. Abel considers the glenoid fossa is simply a notch, *not* an articulation. The length of the complete bone is 245 mm., 9⅝ in., and the bones are flattened, but not crushed or distorted.

If we adopt Dr. Abel's view that the bone is a coracoid we are confronted with the following extraordinary conditions: the precoracoid process is longer than the acrocoracoid, Dr. Abel's processus furcularis, and the acrocoracoid aborted, being reduced to a low, rounded mass of bone, without articular faces of any kind. The articulation of the scapula with the coracoid would be by means of a ball-and-socket joint and, were a humerus present, it would rest against the anterior end of the coracoid, with nothing in advance of the shoulder joint. For, it must be repeated, the anterior end of the bone, be it pelvis or coracoid, is absolutely complete, save a chip off the point of the "precoracoid"; it was never any longer. Then, too, the proximal end of the alleged coracoid is thin and narrow, whereas the coracoid in all other birds, and particularly in flightless birds, is expanded where it articulates with the sternum. Finally the texture of the bone is dense and not bird-like.

If the bones are the coracoids of a bird they represent a type of shoulder girdle entirely different from any with which we are at present acquainted, and the bird from which they come not only belongs to a new species and genus, but to a new order or superorder.

There is not the slightest resemblance between the bone named by Dr. Abel *Alabamornis* and the coracoid of *Anthropornis* which is a perfectly normal avian coracoid; nor is there any resemblance between it and the coracoid of *Gastornis*, which is long and slender, the only peculiarity being that it belongs to a degenerate shoulder girdle and its characters are not sharply defined.

Dr. Abel's surmise that *Diatryma* and *Alabamornis* may be one and the same is best answered by noting that not only are the bones separated by many hundred miles of space, but that one comes from the Lower Eocene, Wasatch, the other from the Upper Eocene, Jacksonian. Now, I will not insist that the bones under discussion represent the pelvis of zeuglodon nor deny that they are the coracoids of a bird; I will simply say that it seems to me doubtful that this last ascription is correct and wait for further discoveries to throw more light on the problem. F. A. LUCAS

CLADODUS COMPRESSUS, A CORRECTION

IN the Thirtieth Annual Report of the Indiana Department of Geology and Natural Resources, page 1378, I named a new species

of Cladodontidæ *Cladodus striatus*. As the name *striatus* was preoccupied, having been applied by Agassiz to a species of *Cladodus* from the Devonian, I suggest that the new species be named *Cladodus compressus*. The following is the original description.

Cladodus compressus

Teeth of medium size, base of type specimen 14 mm. wide by about 5 mm. long, tooth broader than high. Outline of base subelliptical, extremities subangular, posterior border with stronger convexity than anterior; under surface smooth, upper surface with a narrow furrow just behind the cones running parallel with the posterior margin of the base, a strong ridge between this furrow and the posterior margin. Middle cone low, broad and thin near base, twice as broad as thick, with sharp cutting edges; outer lateral denticles broad, thin, and very low, one third to one fourth height of median cone; between lateral denticles and median cone a high narrow ridge that bears two minute denticles on one side of the median cone but none on the other side in the type specimen; median cone and lateral denticles all marked with almost vertical, narrow, sharp-crested ridges; spaces between ridges about twice as broad as ridges.

C. compressus differs from *C. euglyphæus*, the nearest allied species, in its much larger size, much greater breadth of median cone, greater breadth and less height of outer lateral denticles, smaller number of lateral denticles, high ridge between outer denticles and main cone, and in the greater approximation of the ridges on the teeth.

Formation and Locality—Salem limestone, Paynter's Hill, Ind.

Type specimen No. 7709—1 American Museum of Natural History.

E. B. Branson
Geological Department,
Oberlin College

THE TERM "THERM"

To the Editor of Science: I have noted in the recent issues of Science discussions in regard to the use of the term "Therm" as a simple way of expressing 1 million gram calories.

While this old term used in a new sense may simplify an expression, it, however, to my mind makes it more complicated as far as its actual meaning is concerned.

The trend to-day in all scientific matters, and primarily it is the object of research, is to bring all phenomena and facts down to a common basis of understanding so that as far as possible one can tell at a glance what the subject is about.

The arbitrary use of a term without the sanction or adoption by the majority of persons or countries engaged in research of the kind to which the term is to be applied, tends more to confuse than to simplify matters.

I am heartily in accord with the suggestion for the term kilo-calorie, mega-calorie, etc., made by A. T. Jones in Science of January 3, 1908.

Lewis W. Fetzer
Maryland Agricultural
Experiment Station,
College Park, Md.

SPECIAL ARTICLES

NOTES ON THE OCCURRENCE OF THE RECENTLY DESCRIBED GEM MINERAL, BENITOITE

During the course of the writer's investigations in the Coalinga oil field, Fresno County, California, the past summer, he was accorded the opportunity of examining the mine from which the new gem mineral, benitoite, is obtained. At the time Dr. Louderback[1] described the mineral, he had examined only a limited amount of material and had had no opportunity of visiting the type locality. The following notes on the field relations of the gem are therefore offered as an addendum to his paper. The writer wishes to extend his thanks to the owners of the mine, Messrs. R. H. Dallas and L. B. Hawkins, the latter one of the discoverers of the mineral, for permission to visit the mine, for the gift of a representative series of specimens, and for other courtesies.

Benitoite, according to Louderback and

[1] "Benitoite, a New California Gem Mineral," by George Davis Louderback, with chemical analyses by Walter C. Blasdale: *Bull. Dept. Geol., Univ. Calif.*, Vol. V., No. 9, pp. 149–153, July, 1907.

Blasdale's determination is a very acid titanosilicate of barium possessing the following properties: It varies in color from dark blue through light blue to colorless, this property having led to the original belief that the gem was sapphire. The pleochroism is very marked, the ordinary ray being colorless, while the extraordinary is blue, with a violet tint when intense. The absorption is $e > 0$. The refractive indices are high, $0 = 1.77$, $e = 1.80$, in sodium light. The double refraction is therefore very strong and the mineral optically positive. Benitoite crystallizes in the hexagonal system, trigonal division, the most common habit being pyramidal. The individual crystals are usually less than a centimeter in maximum diameter, although they occasionally attain a size of 2.5 centimeters (one inch). The hardness is 6¼ to 6½, or below quartz; the density is 3.64 to 3.65. The mineral fuses at about 3, is almost insoluble in hydrochloric acid, quite easily attacked by hydrofluoric acid, and dissolves readily in fused sodium carbonate. Associated with the benitoite is a black or brownish-black prismatic mineral which Dr. Louderback believes to be new, and to which he has given the name carlosite.[2]

Benitoite and carlosite occur as individual crystals associated with veins or geodes of a white zeolite (which Mr. W. T. Schaller has identified as natrolite), in a great schist lens, enclosed by one of the largest areas of serpentine found in the Coast Range of California. This serpentine mass occupies five or six miles of the crest of the ridge north of White Creek in the western part of Fresno County, twenty-five miles northwest of Coalinga, and extends northwestward at least four or five miles into San Benito County. Many irregular lenses and masses of schist and several kinds of more or less basic igneous rocks are associated with the serpentine. The particular schist lens containing the gem mineral cuts through a low hill of serpentine at the bend in one of the headwaters of the San Benito River. The lens is about 150 feet wide at its widest part, at least 1,200 feet long, strikes about N. 70° W. and appears to dip N. 20° E. at angles varying from 70° to 80°. The relations are best studied in the shallow cuts, which comprise the present development works, and which are confined largely to the middle of the southeastern portion of the lens.

The country rock of the gem-bearing natrolite veins is a schist containing glaucophane, and varying in color from dark greenish gray to a rather light blue. Near the lower or southwestern contact with the serpentine (the latter being soft, light-colored and containing numerous thin, flaky asbestos veins) the schist is dark greenish, fine-grained, and breaks with a sharp-edged angular fracture. It contains veins up to three eighths of an inch in thickness, of a light greenish mineral, resembling chlorite, which can be scratched with a knife. The joint faces are coated with thin films having the characteristics of manganese oxide. A peculiar-looking mineral, somewhat resembling iron pyrites in appearance, but quite soft, occurs sparingly in thin veins throughout this part of the lens. Some faint copper stains were also noted at one place. In the immediate vicinity of the gem-bearing veins toward the middle of the schist area the rock is blue, has been considerably altered, probably by the waters carrying the vein and gem-forming materials, and breaks with a fine, granular fracture exposing component crystals discernible with the unaided eye. The schist adjacent to the veins is often largely replaced by natrolite. The planes of schistosity are more plainly visible in the bluer variety, which is apparently the richer in glaucophane. Where extremely weathered and wet the altered schist has the appearance and feel of a tough blue clay. Weathered surfaces of the schist are rough, sometimes being covered by mammilliform nodes. This nodular occurrence is also encountered below the surface in the more weathered and porous portions of the rock. The color of the weathered surfaces is bluish gray to reddish brown, the latter due to iron oxide. The schist usually weathers faster than the natrolite or benitoite and seems to have been protected over those areas which once formed the wall or is at present covered with the remains of a natrolite vein. On one

[2] *Op. cit.*, p. 153.

exposed rock surface about 2½ by 4 feet were over 200 more or less imperfect benitoite crystals, amid thin patches of remaining natrolite, the whole standing out prominently from the surrounding rough and unprotected surface of the schist.

The altered portions of the schist are full of cracks and cavities, varying in size up to two or three inches in width, and having a rough orientation parallel to the planes of schistosity. The cavities are for the most part filled with natrolite, with which benitoite or carlosite or both are often associated. The natrolite is not always accompanied by benitoite and carlosite, but in no instance noted did the benitoite occur without the natrolite and in only a few cases was the carlosite found alone. A soft dark brown mineral substance, resembling cadmium oxide, is also sometimes associated with the natrolite. It is not uncommon to find the cavities only partially filled, in which case the occurrence resembles a geode, the crystals of the natrolite (sometimes associated with benitoite and carlosite) forming the inner surface. The natrolite in such cases is usually coated with a brownish or brownish-yellow stain, or is covered by an intricate mass of microscopic, needle-like crystals of a peculiar greenish-drab color.

As a usual thing the benitoite and carlosite are in contact with the country rock, the carlosite sometimes having one extremity buried in it, while the remainder of the crystal extends into the natrolite. One instance was noted where a long slender carlosite crystal extended across a vein of natrolite with an extremity penetrating the schist on either side. The facts above noted imply the crystallization of the benitoite and carlosite previous to the complete deposition of the natrolite. Isolated crystals of the benitoite and carlosite are not rare in masses of natrolite, however, so that possibly the crystallization of the three minerals was practically contemporaneous, at least in certain instances. In some cases the benitoite appears to be entirely surrounded by the schist, but a close examination usually reveals a thin film of natrolite between the former and the country rock. In the places where the carlosite occurs alone or associated with only minor quantities of natrolite, the carlosite is in the form of thin veins, the crystals being imperfect and forming a series of thin plates or flakes. Close associations of the benitoite and carlosite are not uncommon and indicate contemporaneity of origin for the two minerals. No alteration of the natrolite or benitoite was noticed, but red stains resembling iron oxide were seen emanating from around several of the carlosite crystals. Mr. Schaller has called the writer's attention to the fact that minute fragments of the carlosite also show a brick-red color, so that the coloring around the crystals may be due to fine particles of the unaltered mineral.

Development work has so far been confined to near the middle of the schist lens, and consists of a tunnel and several open cuts following the strike of the schist. The tunnel is 50 feet long and the largest cut 10 feet deep, 4 feet wide and 14 feet long. The gems are secured either by pounding up the richer portions of the matrix and then picking out the few crystals or fragments that have withstood the shock, or else chiseling out the larger individual crystals at the expense of the smaller surrounding ones. Only a small percentage of the gems are saved by either method, as the crystals are very brittle and usually considerably jointed and cracked. The present value of the cut stones is said to be $40 per carat.

Ralph Arnold

Coalinga, California,
September, 1907

NOTES ON ORGANIC CHEMISTRY

KETEN

A number of derivatives of ketene have been known for some time and the announcement has just been made of the preparation of the parent compound.[1] This substance is of great interest because it is the simplest member of the highly important class of ketones and, moreover, it is the simplest anhydride of acetic acid. Its mode of formation and reactions show that its formula is $H_2C:CO$, *i. e.*, it is *methylene ketone;* the

[1] N. G. M. Wilsmore, *Jour. Chem. Soc.* (London), **91**, 1938 (1907).

relationship to acetic acid may be indicated by the expression,

$$H\,CH_2\,CO\,OH\ .$$

Ketene is prepared by bringing liquid acetone, ethyl acetate, or, preferably, acetic anhydride into contact with a glowing platinum spiral; instead of the spiral an arc burning between carbon or metallic poles may be employed. The gaseous products of the reaction are passed through a condenser and then cooled to —100° in liquid air. Ketene is a colorless gas at the ordinary temperature, but it may be liquefied and frozen, and it has a peculiar penetrating odor. Its molecular weight agrees with the simple formula given above, but the substance undergoes polymerization rather readily, as would be expected. Ketene does not react with *dry* oxygen, but it quickly combines with water forming acetic acid; with alcohols it gives the corresponding acetates. Moreover, it is an admirable acetylating agent. With aniline, for example, it yields pure acetanilide directly, and similar compounds are obtained with other primary amines. These reactions demonstrate the correctness of the formula for ketene given above. The further investigation of this interesting substance should yield results of decided value.

J. BISHOP TINGLE
McMASTER UNIVERSITY

THE BALLONS-SONDES AT ST. LOUIS

A FINAL series of ascensions of *ballons-sondes,* or registration balloons, at St. Louis was completed in November, 1907, by Mr. S. P. Fergusson, of the Blue Hill Observatory, under the direction of the writer. These experiments to obtain the meteorological conditions at great heights in America were begun in 1904, with the cooperation of the authorities of the Louisiana Purchase Exposition, as related in SCIENCE, Vol. XXI., pages 76–77, and were continued during subsequent years with the assistance of grants from the Hodgkins Fund of the Smithsonian Institution. Seventy-six balloons have been despatched and all but six have been recovered with the attached instruments, while there is the possibility of the number lost being further reduced by the finding of three of those sent up last autumn. The preliminary results of the earlier ascensions are given by the writer in the *Proceedings of the American Academy of Arts and Sciences,* Vol. XLI., No. 14, and are discussed by Mr. H. H. Clayton in *Beiträge zur Physik der freien Atmosphäre,* Band 2, Heft 2. The object of the recent ascensions, twenty-one in number, was to supply data for the high atmosphere during the autumn, a season when there were few observations, and also to compare with those obtained simultaneously in Europe on the international term-days in October and November. The work at St. Louis at the time of the international balloon race was facilitated by the cooperation of the Aero Club of St. Louis. An examination of the record sheets recently returned indicates generally the presence, at an altitude exceeding eight miles, of the isothermal, or relatively warm stratum, which was found somewhat lower in summer. For example, on October 8 the minimum temperature of —90° Fahrenheit was found at a height of 47,600 feet, whereas at the extreme altitude reached, namely 54,100 feet, the temperature had risen to —72°. Similarly, on October 10, the lowest temperature of —80° occurred at 39,-700 feet while —69° was recorded at 49,200 feet, the limit of this ascension, showing that the temperature-inversion had come down about 8,000 feet in two days. The prevailing drift of the balloons last autumn was from the northwest, whereas in previous years they traveled more from the west.

Professor Moore, chief of the United States Weather Bureau, announces that, in view of the success achieved by the Blue Hill experiments, he will send up *ballons-sondes* simultaneously from various stations.

A. LAWRENCE ROTCH
BLUE HILL METEOROLOGICAL OBSERVATORY,
January 9, 1908

CARL VON VOIT

FROM Munich announcement is made of the death of Carl von Voit in the seventy-seventh year of his age. Voit was born at a time when his native land was poor and when there

were no such palaces of learning nor such armies of students as now characterize university life in Germany. His doctor's thesis presented in 1856 was upon the subject "Contributions to the Circulation of Nitrogen in the Animal Organism." In 1860 Voit was made professor extraordinarius in physiology, and in 1863, at the age of thirty-two, was created professor ordinarius and conservator of the physiological institute at Munich, positions which he held until his death.

At the age of twenty-six Voit had demonstrated that the nitrogen in the excreta of an animal could be used as a measure of the animal's proteid metabolism. At the age of thirty-five (1866) his ideas had led to the construction of the Pettenkofer respiration apparatus, and with Pettenkofer he had determined the amount of metabolism in a healthy person on various diets, during fasting and during work, and also the metabolism in patients suffering from diabetes and leukæmia. These experiments established once for all the principles of nutrition upon a scientific basis. Waves of criticism have broken upon them and left them untouched. Then in his afterlife more and more details upon the subject were given to the world. These are to be found throughout the fifty volumes of the *Zeitschrift für Biologie,* of which he was one of the founders. He said last summer: "If I spent my time answering those publications which are only rediscoveries of what I have already shown, I would have nothing else to do."

Voit was always keenly interested in his lectures and his teaching. His joy at a new discovery by any one in his laboratory was inspiring to all who worked there. He was conscientious in every relation in life. An assistant once addressed some flattering remarks to him and received the sharp rejoinder "Es macht nichts *wer* Recht hat, nur dass die Wahrheit herauskommt."

The clinicians Friedrich Müller, F. Moritz, and a son Fritz Voit received their early scientific training in Voit's laboratory, and have carried this knowledge to a wide scope of usefulness in clinical medicine.

Of the physiologists and hygienists who have belonged to the "Munich school" of Voit may be mentioned Rubner, Lindemann, Straub, Ellinger, Otto Frank, Erwin Voit, Prausnitz, Max Gruber, Cremer, Weinland, Heilner, Atwater and Yandell Henderson.

In the midst of conflict among others concerning his views Voit was always calm, and assumed a waiting attitude, trusting to time for his justification. He deprecated hurried publication of results. His last article gave to the world work accomplished seventeen years before.

Voit was honored as among the highest in his own land, but he would have been a great man in any country. He was one of those spirits whose lives are the heritage of mankind. It only requires knowledge of his work to realize that his fame will grow greater as the years pass by.

Graham Lusk

SCIENTIFIC NOTES AND NEWS

The council of the senate of Cambridge University has reported the opinion that the university should hold a Darwin celebration in the course of the year 1909. The senate is reminded that Charles Darwin was born on February 12, 1809; and that "The Origin of Species" was published on November 24, 1859. The one hundredth anniversary of the former event and the fiftieth anniversary of the latter will, therefore, fall in the course of the year 1909. The council does not think it advisable, so long beforehand, to enter into any details; but suggests that representatives of universities and other learned bodies, together with distinguished individuals, should receive invitations to visit the university on the occasion. Should this report be confirmed by the senate, the council will appoint a committee to consider the details of the proposed celebration. The week begianing June 20, 1909, appears to the council to be the most suitable time for the celebration.

Dr. Robert Koch, the eminent German bacteriologist, expects to visit this country during the spring of the present year. He proposes to rest for a year from his scientific work and has refused all invitations to lecture while in the United States.

PRESIDENT JUDSON closes his last quarterly statement of the condition of the University of Chicago with the following words:

During the current quarter the university has been honored in the person of one of its faculty in recognition of brilliant work of investigation and discovery in the department of physics. Professor A. A. Michelson, head of that department, was awarded the Copley medal by the Royal Society of London. Only one American heretofore, Professor Newcomb, of Washington, has received that medal.

While Professor Michelson was on the ocean on his way to receive this distinguished honor, the official award of the Nobel prizes by the Royal Society of Sweden was announced. Among the awards was one to Professor A. A. Michelson for his discoveries in the measurement and analysis of light. Professor Michelson was obliged to continue his trip from London to Stockholm in order to receive this new and striking evidence of the importance of his tireless and brilliant scientific work. Such recognition of the results of scientific investigation is a renewed incentive to research in all fields of university activity. We, Mr. Michelson's colleagues, unite in felicitations to that modest gentlemen, and, on his return to his home, we hope to extend our greeting and congratulations in a more tangible form.

THE sixty-first birthday of Mr. Thomas A. Edison was celebrated by a dinner, given by the heads of the departments of his laboratory, on February 11.

THE former students and friends of Dudley Allen Sargent, A.M., Sc.D., M.D., director of the Hemenway Gymnasium, Harvard University, have presented him with a bronze medallion. The medallion, designed by Dr. R. Tait McKenzie, has above the face of Dr. Sargent the words "Dudley Allen Sargent, Pioneer in Physical Education, 1907," while on the reverse is a row of five Harvard seals below the words, "A Recognition by his Friends and Students." Two hundred and thirty persons contributed to the medallion fund. A plaster model of the medallion and a bound volume containing the autographs of the contributors to the fund were presented to Dr. Sargent by Dr. Luther Halsey Gulick at the twenty-fifth commencement of the Sargent Normal School of Physical Training, held in Sanders Theater, June 1, nineteen hundred and seven. The bronze medallion was finished recently and presented to Dr. Sargent. The Sargent Medallion Committee is having struck a limited number of copies of the medal. These are to be presented to President Roosevelt, William Taft, Secretary of War, Major General Bell, Curtis Guild, Governor of Massachusetts, and Booker T. Washington, who were all students under Dr. Sargent.

THE occupation of the Smithsonian table in the Naples Zoological Station has been approved for three months from January 9, 1909, on behalf of Dr. Charles A. Kofoid, associate professor of histology and embryology in the University of California.

DR. E. B. ROSA, physicist, of the Bureau of Standards, has sailed for Europe, where he will spend three or four months in a study of methods for harmonizing standards of light in the gas and electric industries.

W. O. CROSBY, emeritus professor of geology of the Massachusetts Institute of Technology, has returned from Alaska, where he has been engaged in private work since August. He returned by way of Panama in order to see the recent progress on the canal. He is now engaged in work for the New York Metropolitan Water Board.

MR. C. WILLIAM BEEBE, curator of birds in the New York Zoological Park, will sail with Mrs. Beebe on February 20 for Georgetown, British Guiana, for the purpose of spending five weeks in the exploration of some definite section of the Essequibo River. The object will be primarily the study of the rich avifauna of that region under natural conditions, its general aspects and its relations to other classes of the fauna.

PROFESSOR GEORGE D. OLDS, of Amherst College, is to attend the International Congress of Mathematicians to be held in Rome from April 5 to 11.

DR. FORREST SHREVE, associate professor of botany in the Woman's College of Baltimore, has accepted an appointment to the staff of the Desert Botanical Laboratory of the Carnegie Institution at Tucson, Arizona.

Dr. R. B. Sosman, of the Massachusetts Institute of Technology, formerly connected with the research laboratory of physical chemistry, who received the doctor's degree from the institute last June and who has been for the past year in the office of A. D. Little, of Boston, has accepted a position at the Geophysical Laboratory of the Carnegie Institution in Washington.

Mr. C. V. Hartman, curator of the ethnological section at the Carnegie Museum in Pittsburg, has received the call to a similar position at the ethnological department of the Riks-museum in Stockholm.

Chum Zen Chan, a graduate of the College of Agriculture of the University of California with the class of 1907, has been made director of the agricultural experiment station at Mukden, Manchuria.

At the annual general meeting of the British Institution of Mechanical Engineers on February 21 the usual council prizes offered for the best papers read before the Graduates' Association during the preceding session were awarded to Mr. H. H. Broughton for his paper "Notes on the design and equipment of electric traveling cranes," and to Mr. A. B. E. Cheeseman for his paper on "Portland cement and the machinery used in its manufacture."

The second lecture of a series supported by a bequest of James Hamilton to the Smithsonian Institution, known as the Hamilton lectures, will be delivered April 22, at the time of the annual meeting of the National Academy of Sciences in Washington, by Professor George E. Hale, director of the Mount Wilson Solar Observatory, California, on "Some Recent Advances in Our Knowledge of the Sun." The first use of this fund, with accumulated interest, was made in 1905, when Dr. Andrew D. White delivered a lecture on "The Diplomatic Service of the United States with Some Hints toward its Reform."

Dr. E. B. Titchener, Sage professor of psychology at Cornell University and nonresident professor of psychology at Columbia University for the current year, began on February 17, at Columbia University, a course of eight lectures on "The Elementary Psychology of Feeling and Attention."

Dr. L. O. Howard, chief of the Bureau of Entomology, lectured, on February 17, before the New York Academy of Sciences on "Some Recent Discoveries in Insect Parasitism, and the Practical Handling of Parasites." One of the features of the lecture was the description of studies upon, and results as to, exterminating the gypsy moth. The lecture was secured through cooperation with the New York and Brooklyn Entomological Societies.

The seventh lecture in the Harvey Society course will be delivered by Professor Otto Folin, of the Harvard Medical School at the New York Academy of Medicine on Saturday, February 22, at 8:30 P.M., on "Problems of Chemistry in Hospital Practise."

Professor A. Lawrence Rotch, director of the Blue Hill Meteorological Observatory, delivered an illustrated lecture on "Sounding the Ocean of Air," before the Stamford Scientific Society, on February 7.

Dr. Harvey W. Wiley, chief of the Bureau of Chemistry, spoke on February 13 at the Boston City Club on "The ethics of the food and drug trade."

Dr. L. A. Bauer, director of the department of terrestrial magnetism of the Carnegie Institution, lectured at Columbia University on February 11, on "The Magnetic Survey of the Pacific Ocean."

Dr. Osler, regius professor of medicine at Oxford, presided on February 4 in the Town Hall, when the Lees and Raper memorial lecture was given by Mr. W. McAdam Eccles, F.R.C.S., whose subject was "The Relation of Alcohol to Physical Deterioration and National Efficiency."

A memorial service for the late Professor O. Lassar was held, January 20, in the amphitheater of his clinic at Berlin under the auspices of the Dermatological Society. Professors Rosenthal and Mayer delivered the main addresses.

We regret to record the death of M. Albert Loewy, professor of mathematics at the School of Physics and Chemistry at Montsouris.

THE death is also announced of M. A. Lancaster, director of the meteorological department of the Royal Observatory of Belgium at Uccle.

THE Cooper Union recently received a bequest of $100,000 from the estate of Mr. Willis James, and the City of New York has now transferred to the institute the sixty-ninth Regiment Armory.

MR. L. S. TIFFANY has presented to the University of Chicago for the Department of Geology a valuable collection of invertebrate fossils. This collection was made by Mr. Tiffany's father during a period of some twenty-five or thirty years and at a cost of many thousands of dollars.

THE president of the United States on February 10, sent to the congress the following message:

To the Senate and House of Representatives:

I transmit herewith a report by the Acting Secretary of State covering a note from the Imperial German Ambassador by which is communicated the acceptance by the International Congress on Hygiene and Demography of the invitation extended to it in pursuance of the joint resolution of Congress approved February 26, 1907, to hold its next session at the city of Washington in 1910.

THEODORE ROOSEVELT

THE first regular meeting of the Illinois Academy of Sciences will be held at the James Millikin University, Decatur, Ill., on February 22. In the morning there will be a session for the presentation of papers and in the afternoon a symposium on "The Atmosphere," embracing the following among other aspects: Origin and Maintenance; Chemical Constitution and Activity; Physical Phenomena; Relations to Animal and Vegetable Life; Relations to Human Evolution and to Mental and Physical Efficiency. In the evening Professor A. A. Michelson, of the University of Chicago, will give a lecture complimentary to the citizens of Decatur on "Recent Advances in Spectroscopy."

THE mathematical and physical library of the late Professor A. S. Herschel, F.R.S., and also works from the library of the late Mr. F. Moore, author of books on the Lepidoptera of India and Ceylon, are offered for sale by Mr. T. Thorp, Guilford, Surrey, England.

WE learn from the *Scottish Geographical Magazine* of the wreck of the *Austral,* the vessel which was taking a party and instruments to set up a meteorological station on Wandel Island. The wreck took place very soon after the vessel left port, and as all the valuable meteorological instruments were lost, the establishment of the new station will be delayed for at least a year. The *Austral* was formerly the *Français,* the vessel of Dr. Charcot's Antarctic expedition.

IT is reported that President Roosevelt will appoint a Pure Food Commission of chemists from various universities, to consider cases of dispute against the rulings of the Department of Agriculture.

THE council of the National Academy of Sciences has passed resolutions in favor of the setting aside of forest reserves in the Appalachian and White Mountains as follows:

WHEREAS: Under the present drain upon the forest the timber supply of the entire United States will be exhausted within twenty years while in the eastern states where no adequate means have been employed to protect the forest the end of the supply is even nearer.

WHEREAS: The headwaters of all important navigable streams to the west of the Mississippi River are now protected by national forests while the Appalachian Mountains, which form the watersheds of many navigable streams of great importance are entirely unprotected and are being damaged to a menacing extent by the wasteful cutting of the forest, unrestricted fires and injudicious clearing;

Resolved, That the council of the National Academy of Sciences heartily favors the extension of the national forest system to the Appalachian Mountains for their protection and permanent utilization;

Resolved, That we urge upon Congress the passage at the present session of a bill to acquire in the Southern Appalachian Mountains and the White Mountains such forest lands as are necessary to protect the navigable streams which have their sources therein, and to make permanent the timber supply of the eastern part of the United States.

A NEW Psycho-neurological Institute, under the direction of Professor Bechterev, was recently opened at St. Petersburg.

THE foundation stone of an Institute for the Study and Prevention of Infant Mortality was laid in Berlin in the presence of the German Empress on December 3.

A CRIMINOLOGICAL INSTITUTE is to be established in connection with the government prison at Buenos Aires. Particular attention will be paid to criminal psychology and forensic psychiatry.

THE seventh meeting of the International Congress of Criminal Anthropology will open at Turin on April 28, under the presidency of Professor Lombroso. Communications relating to the congress should be addressed to the Secretariate of the Congress, Instituto di Medicina Legale, Via Michelangelo, 26, Torino, Italy.

THE city of Paris has placed a building at the disposal of the International Hygienic Institute which is about to be established.

FOR the purpose of promoting the forestry industry in south Manchuria, the Chinese officials have engaged a Japanese expert from Tokyo to act as head master for the proposed school of forests at Mukden for a term of four years, with two Chinese gentlemen as his assistants; but, owing to the lack of funds, the school has not yet been opened.

THE government of Mysore has, according to foreign journals, made public the new rules for regulating the grant of scholarships for scientific research and technical education from the Damodar Dass charities fund. The scholarships will be open to all Indians who have taken with credit a degree in arts, medicine, or engineering in an Indian or other recognized university. Each candidate selected will be given traveling allowance to England or elsewhere from Bangalore on the completion of his course of study or research. He will be allowed, during his stay in England or elsewhere, outside India, a sum of 200*l.* per annum, this allowance to be inclusive of college fees, cost of books, instruments, and boarding charges.

UNIVERSITY AND EDUCATIONAL NEWS

THE contract for the new biological and geological laboratory of Amherst College has been awarded and work will begin when the frost leaves the ground. The building should be completed by January 1, 1909.

MR. CULLOM presented to the senate on February 10 a resolution of the Association of American Universities assembled in convention at the University of Michigan, Ann Arbor, Mich., which was referred to the Committee on Foreign Relations and ordered to be printed in the *Record,* as follows:

WHEREAS: The executive committee of the Latin-American Scientific Congress had determined to make the next congress "Pan-American" instead of "Latin-American"; and

WHEREAS: The Chilean government has extended an invitation to the government of the United States to participate in this congress, to assemble at Santiago, Chile, in December, 1908; and

WHEREAS: This congress will serve to bring the best thought and experience of America to bear on the great problems common to all the republics of this continent and will thus serve to strengthen the ties between the American nations: be it

Resolved by the Association of American Universities assembled in convention at Ann Arbor, Mich., That the Congress of the United States be earnestly requested to make provision for adequate representation at this forthcoming Pan-American Scientific Congress, as recommended in the report of Secretary Root of December 19, 1907, and in the special message of the President of December 21, 1907.

DR. R. W. STIMSON has resigned the presidency of the Connecticut Agricultural College to become president of Smith's Agricultural School, recently established at Northampton, Mass.

C. F. HARDING, a graduate of the electrical engineering department of the Worcester Polytechnic Institute in the class of 1902, has been appointed professor of electrical engineering at Purdue University.

MR. L. BREBANT, M.A. Oxon., has been appointed assistant to the professor of moral philosophy in the University of St. Andrews.